Incidence, aetiology and pattern of mandibular fractures in central Switzerland

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Summary

PURPOSE: The two major causative factors for mandibular fractures, as stated in the literature, are either interpersonal violence or motor vehicle accidents. The purpose of this study was to describe epidemiological trends of mandibular fractures in Switzerland. A special emphasis was directed towards the potential impact of socio-economic standards on the mechanism and pattern of mandible fractures.

PATIENTS AND METHODS: A database of patients aged over 16 years who had been diagnosed with a mandibular fracture between January 2000 and December 2007 at the University Hospital of Bern, Switzerland’s largest Cranio-Maxillofacial-Surgery Centre, was retrospectively reviewed. Patients’ data including gender, age, mechanism of accident, fracture site and associated injuries were analysed and compared with previously published data.

RESULTS: There were a total of 420 patients with 707 mandibular fractures. The two most common causes of injury were road traffic accidents (28%) and various types of sports injuries (21%). A total of 13% of the patients were under the influence of alcohol or drugs at admission. Fractures were predominantly situated in the condyle/subcondyle (43%) and in the symphysis/parasymphysis region (35%). Occurrences of fractures in the angle and in the body were low, at 12% and 7% respectively.

CONCLUSION: In contrast to other highly developed countries, sports- and leisure-related accidents outnumbered motor vehicle accidents and altercations. The data presented here supports the assumption of a correlation of trauma cause and fracture pattern.

Key words: trauma; epidemiology; mandibular fracture; Switzerland

Introduction

Mandibular fractures are the second, most-frequent facial injuries treated at a trauma centre. According to several studies, they account for 15.5% to 59% of all facial fractures [1–4]. The epidemiological data for facial and mandibular fractures varies among countries and changes over time. The aetiology of cranio-maxillofacial injuries is multi-factorial, mostly depending on socio-economic, demographic, cultural, technological and environmental factors. Therefore, the main mechanism of injury for mandible fractures is inconsistent in the literature.

Interpersonal violence is the most common cause for mandibular fractures in North-American countries [5–8], North European countries [2, 9, 10], Australia [11, 12] and New Zealand [13, 14]. In newly industrialising and less developed countries such as Jordan [15] or Nigeria [16], motor vehicle accidents are the most common cause for mandibular fractures.

In 2005, the World Bank reported that Switzerland was the richest country in the world, with a per capita wealth of 648,241 USD [17]. The high socio-economic standard and the alpine surrounding (40% of the surface are mountains) may influence the aetiology of facial trauma in Switzerland. Up to now, no epidemiological data from Switzerland have been published. The aim of this study was to evaluate the epidemiology and fracture pattern of mandibular fractures in Switzerland and compare these data to previously published studies from other highly developed countries. Furthermore, the study tried to shed light on a possible correlation of trauma mechanism and fracture pattern.

Material and methods

![Figure 1](image_url) Trauma mechanism.
The Cranio and Maxillofacial Surgery Unit at the Inselspital in Bern is a level-one trauma centre, which provides maxillofacial trauma coverage for a mainly suburban and rural population of about 2.5 million. Since the introduction of a computer based databank in January 2000, all patient data are recorded at the time of admission to the emergency room. All emergency reports are written and saved as an electronic medical report with the Qualicare program as previously described in the literature [18]. This program permits a text or key word search and can immediately display complete patient notes and progress reports. The observation period for the study was from January 2000 until December 2007.

The search criteria included: lower jaw, mandible, mandibular fracture, condyle, condylar fracture, coronoid, angle fracture, symphysis fracture and parasympysis fracture. Information obtained from the trauma database included the following: patient name, age, sex, trauma date, alcohol and drug abuse, sort of trauma, mechanism of injury, fracture localisation, additional injuries, investigation methods and initial therapy.

In addition to the trauma data bank search, a second text search of all electronic radiological reports from the department of neuro-radiology was performed with the previously mentioned key words. Next, all the medical files of the department of cranio-maxillofacial surgery were scanned in case of incomplete data.

Age was classified into 3 groups: 16 to 29 years old, 30 to 49 years old, and >50 years old. Patients under 16 years of age are also treated by our department, but could not be considered since the children’s emergency room is not connected to the Qualicare database. We considered patients between 16-29 as young adults, who are often described as a risk population for mandibular fractures. The causes of the accidents were grouped into the following categories: road traffic accidents (RTA), interpersonal violence (IPV), sports, falls, occupational accidents, medical condition related accidents and other causes.

Based on the documented radiographic findings, the fracture sites were assigned to one of six anatomical subsites including symphysis/parasympysis, body, angle, ramus, condyle and coronoid process.

**Results**

Over the period of 7 years, 420 patients with a total of 707 mandibular fractures were admitted and treated at the department of cranio-maxillofacial surgery. Thus, the mean number of fractures per patient was 1.7 and the incidence to sustain a mandibular fracture was 0.0024 p.a. The mean age was 37 years with a wide range from 16 to 97 years. With 307 patients being male and 113 female, the male-female ratio was 2.7 to 1.

With 28% of all cases, the leading trauma causes were road traffic accidents (117 patients), which could be subdivided into three main categories: bicycle accidents (59 patients), motor vehicle accidents (31 patients) and motorbike accidents (21 patients) (fig. 1 and 2).

Second in frequency, with 21% of all cases, were various types of sport accidents (88 patients). Ice hockey (28 patients) was the most common activity followed by skiing (23 patients) and contact sports (8 patients) (see fig. 3).

Interpersonal violence accounted for 17% of all cases (72 patients) and was third in frequency, closely followed by falls (16%, 68 patients). The assault-related injuries showed a slightly increasing trend with a peak in 2006 (fig. 4). A total of 13% of all patients were under the influence of drugs or alcohol.

The risk to sustain a fracture of the lower jaw declined with age. It was biggest in the age group between 16 and 29 years, and was lowest in the group over 50 years (table 1). A stratification of the trauma causes according to age is summarised in figure 5.

Of the 707 total fractures, 303 were located in the condylar/subcondylar region, followed by the symphysaal region (246), the angle (87), the body (53), the coronoid process (13) and the ramus (5) (fig. 6). Fractures of the mandibular angle were most often results of sports accidents and alterations (fig. 7). Road traffic accidents were most com-

**Figure 2**

Road traffic accidents.

**Figure 3**

Sport related accidents.

**Figure 4**

Interpersonal violence.
monly associated with condylar and parasymphseal fractures (table 2). A total of 93 patients (22%) had associated maxillary and mid-facial fractures. Brain commotion was observed in 19%, but severe brain injuries were extremely rare. Mandibular fractures were diagnosed using two discrete methods: 198 were diagnosed by using the currently recommended computed tomography and 222 were diagnosed with orthopantomograms and Clementschitsch (reversed Town’s) view only.

Discussion

<table>
<thead>
<tr>
<th>Total</th>
<th>RTA</th>
<th>Sport</th>
<th>Assault</th>
<th>Fall</th>
<th>Occupational</th>
<th>Illness related</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age group 16–29</td>
<td>190</td>
<td>52</td>
<td>54</td>
<td>48</td>
<td>13</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>Age group 30–49</td>
<td>139</td>
<td>46</td>
<td>29</td>
<td>23</td>
<td>18</td>
<td>14</td>
<td>8</td>
</tr>
<tr>
<td>Age group &gt;50</td>
<td>91</td>
<td>19</td>
<td>5</td>
<td>1</td>
<td>37</td>
<td>14</td>
<td>13</td>
</tr>
</tbody>
</table>

Table 2: Correlation of fracture site and trauma mechanism.

<table>
<thead>
<tr>
<th>Symphysis/Parasymphysis</th>
<th>Body</th>
<th>Angle</th>
<th>Ramus</th>
<th>Condyle/Subcondyle</th>
<th>Coronoid process</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTA</td>
<td>73</td>
<td>10</td>
<td>13</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Sport</td>
<td>59</td>
<td>8</td>
<td>27</td>
<td>0</td>
<td>44</td>
</tr>
<tr>
<td>Assault</td>
<td>41</td>
<td>12</td>
<td>26</td>
<td>2</td>
<td>36</td>
</tr>
<tr>
<td>Fall</td>
<td>38</td>
<td>12</td>
<td>11</td>
<td>2</td>
<td>58</td>
</tr>
<tr>
<td>Occupational</td>
<td>17</td>
<td>6</td>
<td>8</td>
<td>0</td>
<td>27</td>
</tr>
<tr>
<td>Illness related</td>
<td>9</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>34</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>6</td>
</tr>
</tbody>
</table>
is striking that the incidence to sustain a mandibular fracture in Switzerland is by far lower than in other countries; however, a comparison of those figures must be done with caution due to unreliable estimates on the served population. Compared to other countries such as Australia, Great Britain, Finland, Bulgaria or Kuwait, the incidence of mandibular fractures in Switzerland is markedly lower [2, 12, 20, 21] (table 3). It is noteworthy that in most publications concerning the aetiology of mandibular or facial fractures neither the number of incidences nor the number of treated patients is listed.

Secondly, the mechanism of trauma differs from previous reports in many aspects. Violence was not a major cause to sustain a mandibular fracture in Switzerland, although assault is known to be a significant predictor for isolated mandible fractures [22]. In contrast to several studies, which report very high rates of interpersonal violence with almost “epidemic proportions” [6, 7, 14, 21], only 17% of all fractures were a consequence of assault in our patient group. For example, a recent study from neighbouring Germany showed a rate of alteration of more than 38% [9]. Some of the explanations for a low violence rate are a low unemployment-rate of roughly 3%, a generous welfare system, and the introduction of a heroin supported therapy for drug addicts in 1994 financed by the health insurance and the city, which significantly reduced drug-related crime. Nevertheless, it should not be concealed that the rate of alteration also increased in our patient population during the observation period. The explanations for this phenomenon and the peak in 2006 can only be speculative. On the other hand, it must be pointed out that none of the cases involved a gunshot wound despite a very high percentage of privately owned small arms in Switzerland [24].

Another finding that contrasts with previous epidemiological studies is the high incidence of sports related fractures with 21% of all cases. The actual number was probably even higher than reported because many of the cycling accidents were probably falsely categorised under road traffic accidents, but were in fact sport related accidents. The predominance of certain sports activities varies from country to country, and depends mostly on cultural and environmental factors [25]. In New Zealand, for example, more than half of all sports related facial fractures are the result of playing rugby [25]. In our study, winter sports accounted for 58% of all sport related injuries with playing ice hockey as the leading cause. Based on the amount of winter sport accidents (93 090 persons a year), the estimated incidence of mandibular fracture (0.01%) is however very low. These findings are consistent with the figures from the Swiss Counselling Centre for Accident Prevention (BFU). In 2007, the BFU documented that with regard to facial injuries, ice hockey was by far the most dangerous of all sports activities (BFU). In both ice hockey and skiing, the protection by helmets is insufficient in the prevention of mandibular fractures. Also in cycling, conventional helmets are incapable of preventing injuries to the lower face. In our study, cycling accidents accounted for half of all road traffic accidents and outnumbered motor vehicle accidents (MVAs) by far, which are the most common cause for mandibular fractures in many countries [8, 16, 26]. Compared to cyclists, the percentage of helmet use of motor-
of this is to optimise specific protective gear and to guide the treating physician towards a time and cost effective diagnostic workup.

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Literature


Table 3: Incidence to sustain a mandibular fracture in different countries.

<table>
<thead>
<tr>
<th>Country</th>
<th>Incidence p.a. (%)</th>
<th>Study-Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>0.046</td>
<td>Schön R et al. 2001</td>
</tr>
<tr>
<td>Finland</td>
<td>0.009</td>
<td>Oikarinen et al. 2005</td>
</tr>
<tr>
<td>Great Britain (Scotland)</td>
<td>0.007</td>
<td>Ellis E et al. 1985</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>0.006</td>
<td>Bakaradjiev et al. 2007</td>
</tr>
<tr>
<td>Kuwait</td>
<td>0.004</td>
<td>Oikarinen et al. 2005</td>
</tr>
<tr>
<td>Switzerland</td>
<td>0.002</td>
<td>Zip et al. 2011</td>
</tr>
</tbody>
</table>