INCIDENCE, AETIOLOGY AND PATTERN OF MANDIBLE FRACTURES IN SONEPAT, HARYANA (INDIA)

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Abstract

Background: Maxillo-facial fractures can lead to substantial long-term functional, aesthetic and psychological complications, being considered among the most common facial accidents. As, in recent years, a significant increase of such cases has been recorded, the present study aims at describing the incidence, etiology and pattern of mandibular fractures recorded in Sonepat.

Materials and method: A prospective study of maxillo-facial injury cases was carried out at the newly created B.P.S Government Medical College for Women, Khanpur Kalan, Sonepat, from September 2011 to February 2013. Data on patients, including gender, age, mechanism of accident, fracture site and pattern were collected and analysed.

Results: A total number of 474 patients with 86 mandibular fractures was registered, males outnumbering female patients by a ratio of 2.9:1. Age of patients ranged between 9 months and 72 years, maximum incidence occurring in the 18-34 year group of age. Most injuries were caused by road traffic accidents (48.83%), followed by assaults (26.74%) and sporting activities (13.95%). The most prominent site of mandibular fracture was parasymphysis (27.90%), followed by angle (24.41%) and body (18.60%) regions. 30.23% of the patients with mandible fractures were having multiple fracture sites. Also, 10% of the patients with mandible fracture had associated mid-facial fractures. Closed reduction was done in 13.6% of patients, open reduction and internal fixation was performed in 46.4% of cases, while 18.1% of them were treated conservatively. The mean duration of hospitalization was 10.12 ± 6.24 days.

Conclusions: The present study highlights the importance of dental surgery in the management of maxillo-facial injuries and the need to reinforce legislation for reducing their number among both children and adults.

Keywords: mandibular fracture, traffic accidents, assaults.

1. INTRODUCTION

The maxillo-facial region occupies the most prominent position in the human body, being usually highly vulnerable to injuries [1]. Maxillo-facial injuries commonly encountered in the Emergency Department are often associated with high morbidity, resulting from the high care costs. These injuries are of constant interest for researchers, due to the varying degree of physical, functional and cosmetic disfigurement they may cause. The shear pace of modern life with its high-speed travels, as well as an increasingly violent and intolerant society has made facial trauma a form of social disease to which no one is immune. There are changes in patterns of facial injuries, extent, clinical features, etc., resulting in mild-to-massive disfigurement of the maxillo-facial skeleton, along with functional loss.

Mandibular fractures are one of the most frequent facial injuries treated in a trauma centre. According to several studies, they account for 15.5 to 59% of all facial fractures. [2-5] The epidemiological data describing facial and mandibular fractures vary among countries and change over time. The etiology of cranio-maxillo-facial injuries varies from country to country and has a multi-factorial nature, usually attributed to socio-economic, demographic, cultural, technological and environmental factors. Therefore, the main mechanism of injury for mandible fractures described in literature [6-8] is inconsistent.

Interpersonal violence is the most common cause of mandibular fractures in North-America [9-12], North Europe [3,13,14], Australia [15,16] and New Zealand [17,18]. In the newly-industrialized and less developed countries, such as Jordan [19] or Nigeria [20], motor vehicle accidents are the most common cause of mandibular fractures.

Management of injuries in the maxillo-facial complex remains a challenge for oral and maxillo-facial surgeons, demanding both skill and a high
level of expertise [21,22]. Treatment of mandibular fractures has changed over the last 20 years in Western societies, namely a decrease was recorded in the use of wire osteosynthesis and intermaxillary fixation, along with increased preference for open reduction and internal fixation with miniplates.[23,24] This reduced malocclusion and non-union improved mouth opening, speech and oral hygiene, decreased weight loss and increased the ability for patients to return to work earlier [23,25]. However, in resource-limited countries like ours, the lack of expertise and facilities for open reduction and internal fixation, and delayed presentation to the doctor represent major problems, preventing an acceptable cosmetic outcome in maxillo-facial trauma patients.

The district of Sonepat, part of the Eastern Haryana Plain, has an estimated population of 1,480,080 and an area of 2260 km², including 328 villages and 6 towns. Most of the population lives in the rural area. The B.P.S Government Medical College for Women, Khanpur Kalan, Sonepat, the main maxillo-facial trauma centre in the district, conducted a prospective study over a period of 18 months (from September 2011 to February 2013), to assess the incidence, etiology and pattern of mandibular fractures recorded in the region.

Limited information is available on the mandibular fracture patterns in Haryana (India), as no previous study devoted to such topic has been undertaken up to now on such a topic. The aim of the present study was to examine the incidence, etiology, age, gender, anatomical distribution and treatment of mandibular fractures registered in the B.P.S Government Medical College for Women, Khanpur Kalan, Sonepat (Haryana), comparatively with the findings of other studies. The results may aid in identifying the etiological factors involved, in planning subsequent prevention strategies and especially in drawing attention on the necessity of improved safety standards and in educating the younger generation to prevent maxillo-facial injuries.

2. MATERIALS AND METHOD

The prospective study was conducted in the Department of Dental Surgery. Data were collected from patients (with maxillo-facial injuries) attending the Accident and Emergency Department as well as the Outpatient Department of Dental Surgery at B.P.S Government Medical College for Women, between September 2011 and February 2013, by means of a pre-tested questionnaire. Data collected included: patient’s demographic data, cause of injury, type of injury, time of injury, place of injury, status of prehospital care, mode of arrival in the hospital, associated injuries, severity of injury (GCS), treatment modalities and outcome of treatment (i.e.
post-operative complications, duration of hospital stay and mortality). Information relevant to the study was obtained directly from the patient; when this was not possible, collateral history was obtained from either police or relatives attending to the patients.

Detailed clinical examination was done and soft tissue lacerations, tooth injuries, number and site(s) of fracture(s) mandible, associated injuries, etc. were recorded. The diagnosis was based on clinical and radiological findings. In some special cases, CT scan and USG were done to rule out the foreign bodies.

The etiological factors were divided into road traffic accidents, assault and injury associated with fall, injuries due to various causes - including sports, occupational and other related injuries (dog bite, monkey bite, gun shot injuries, etc). Data on the prevalence, age and sex distribution, causes, types and site of injury, treatment modalities and trauma-associated complications were reviewed and analysed. Detailed surveys of these cases with complete data (age, gender, type of injuries, emergency and definite management with different treatment modalities) have been collected, reviewed and analyzed in detail, emphasizing the importance of an early management of mandible fractures in preventing functional as well as aesthetic deformations.

3. RESULTS

The total number of trauma patients reported between September 2011 and February 2013 (18 months) in the Accident and Emergency Department and Outdoor Department of Dental Surgery Unit of B.P.S Government Medical College for Women was 474, with 86 mandibular fractures.

### Age and gender distribution

Patients’ age at the time of injury ranges from 9 months to 72 years, most frequent being the ages between 17 and 34 years. Most of the patients were males (65:21), the recorded male:female ratio being 3:1.

<table>
<thead>
<tr>
<th>S.no</th>
<th>Age-group</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0-17</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>18-34</td>
<td>25</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>35-51</td>
<td>17</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>52-68</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>69 and above</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>65</td>
<td>21</td>
</tr>
</tbody>
</table>

Table 1 - Age and gender distribution

### Monthly distribution of mandibular fractures

The monthly distribution showed the highest incidence in January, followed closely by July. The lowest incidence was registered in September.

![Fig. 2 - Month wise distribution of mandibular fractures](image-url)
ETIOLOGY OF MANDIBULAR FRACTURES

The most common causes of mandibular fractures were road traffic accidents (48.83%), followed by assaults (26.74%) and sports (13.95%).

<table>
<thead>
<tr>
<th>Cause</th>
<th>No. of cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road traffic accident</td>
<td>42</td>
<td>48.83%</td>
</tr>
<tr>
<td>Assault</td>
<td>23</td>
<td>26.74%</td>
</tr>
<tr>
<td>Sport</td>
<td>12</td>
<td>13.95%</td>
</tr>
<tr>
<td>Fall</td>
<td>5</td>
<td>5.81%</td>
</tr>
<tr>
<td>Occupational</td>
<td>3</td>
<td>3.48%</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>1</td>
<td>1.16%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>86</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Table 2 - Aetiology of Mandibular fractures

Out of the patients involved in alleged assaults, 86.5% were males and 14.5% were females. In 9 (10%) of the total 86 patients, mandibular fractures were associated with mid-facial fractures, in 77 of them (90%) only the mandible being involved. Among the mandibular fractures involving the mid-facial area, too, road traffic accidents had the highest incidence: 52%, 44% being caused by assaults and 4% by falls. No associated mid-facial fractures occurred in the other categories of etiology.

Anatomical location of mandibular fractures

The most prominent site of mandibular fractures was parasymphyisis (23.25%), followed by angle (17.44%), body (12.79%), symphysis (8.13%), condyle (5.81%), ramus (2.32%), and coronoid (1.16%). 18.60% of the patients had more than one fracture site.

There was no significant difference between the right (48.8%) and left side (51.2%) of the mandible. The mandible had a single fracture in 53% of cases, 40.6% of them had two fractures, 4.8% - three fractures, and 0.8% had more than three fractures.

<table>
<thead>
<tr>
<th>Site of fracture</th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Parasymphyisis</td>
<td>20</td>
<td>23.25%</td>
</tr>
<tr>
<td>2. Condyle</td>
<td>5</td>
<td>5.81%</td>
</tr>
<tr>
<td>3. Angle</td>
<td>15</td>
<td>17.44%</td>
</tr>
<tr>
<td>4. Body</td>
<td>11</td>
<td>12.79%</td>
</tr>
<tr>
<td>5. Symphysis</td>
<td>7</td>
<td>8.13%</td>
</tr>
<tr>
<td>6. Ramus</td>
<td>2</td>
<td>2.32%</td>
</tr>
<tr>
<td>7. Coronoid</td>
<td>1</td>
<td>1.16%</td>
</tr>
<tr>
<td>8. Combination (more than one site)</td>
<td>26</td>
<td>30.23%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>86</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Table 4 - Anatomical location of mandibular fractures

Mandibular fracture pattern combinations

26 different mandibular fracture combinations involving more than one fracture were observed. The most common combinations were

<table>
<thead>
<tr>
<th>Fracture pattern</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parasymphyisis</td>
<td>20</td>
<td>8</td>
</tr>
<tr>
<td>Condyle</td>
<td>32</td>
<td>5</td>
</tr>
<tr>
<td>Angle</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Body</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Symphysis</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Ramus</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Coronoid</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>54</td>
<td>13</td>
</tr>
</tbody>
</table>

Table 3 - Sex wise frequency of cause of mandibular fracture

Fig. 3 - Aetiology of mandibular fractures

Fig. 4 - Sitewise distribution of mandibular fractures
angle/parasymphysis (11.62%), followed by body/angle (9.30%), subcondyle/parasymphysis (5.81%) and subcondyle/body (4.65%). Out of the assaulted patients, the body/angle combination (10.81%) was the most frequent, followed by angle/parasymphysis (8.10%) and subcondyle/parasymphysis (5.40%). Among the patients injured in sporting activities, the angle/parasymphysis (16.66%) was the most common combination. Sports usually resulted in single fractures of the mandible, whilst RTA patients showed both different combinations and single fractures.

<table>
<thead>
<tr>
<th>Fracture/Combination</th>
<th>Assault</th>
<th>RTA</th>
<th>Sport</th>
<th>Other</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body/angle</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>9.30</td>
</tr>
<tr>
<td>Angle/parasymphysis</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>11.62</td>
</tr>
<tr>
<td>Subcondyle/body</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4.65</td>
</tr>
<tr>
<td>Subcondyle/parasymphysis</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>5.81</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>4.65</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>10</td>
<td>4</td>
<td>5</td>
<td>36.04</td>
</tr>
</tbody>
</table>

Table 5 - Mandibular fracture pattern combinations and aetiology

**Treatment of mandibular fractures**

Primary management of soft tissue injuries - namely suturing, pressure dressing, splinting of bony fragments - was done in the specialized department, while the final intervention in mandibular fracture with close or open reduction and follow up was performed in the Department of Dental Surgery of BPSGMC, Khanpur Kalan, Sonepat. Most of the patients with mandibular fractures (86) were treated by open reduction and internal fixation (ORIF) with miniplates (46.4%). Also, 21.9% of them had ORIF, followed by postoperative intermaxillary fixation (IMF). These patients had multiple fractures, in most cases in the subcondyle region. Conservative treatment (18.1%) usually involved a soft diet, analgesia, ± diazepam, ± antibiotics, the patient being regularly observed over a six week period. Closed reduction was the treatment of least choice in 13.6% of the patients, namely a non-surgical approach of IMF, application of eyelet wires or archbars and wire or elastics for four to six weeks.
The hospitalization stay ranged from 1 day to 26 days (mean duration: 10.12 ± 6.24 days). Patients with multiple maxillo-facial fractures, associated injuries, maxillo-facial burn and those with associated lower limb fractures had a significantly longer hospital stay.

A standard treatment of parental antibiotics, administered intravenously as early as the time of hospital admission, usually amoxycillin (500 mg), ceftaxim (1 gm) and metronidazole (500 mg), followed by their oral administration after 48 hrs or at the time of discharge, was performed. The patients with post-traumatic residual deformities and complications, who addressed the hospital only later after the accident, were also managed as best as possible.

4. DISCUSSION

All over the world, maxillo-facial injuries have continued to generate discussion among researchers, due to the functional and cosmetic deformities affecting the victims. The etiological factors and pattern of maxillo-facial injuries have been reported to vary from one geographical area to another, depending on the socio-economic status, geographic condition and cultural characteristics [26-28].

The predominance of injured males in the 18-34 year age group, agreeing with the findings of other works [21,22,26,27], may be attributed to the fact that, in this period of life, people are more active in sporting, fights, violent activities, industry and high speed transportation. The low frequencies in the very young and old age groups are due to reduced activities.

The male predominance observed in our study agrees with data reported in literature around the world, namely a male-to-female ratio of approximately 3:1 [21,22,26,29]. Males are more exposed, due to their more frequent participation in high risk activities, such as driving vehicles, sports that involve physical contact, an active social life, drugs and alcohol habits, etc.

Most fractures occur in early January, when the winter season is at its full bloom, with dense fog leading to RTA, while also coinciding with the marriage season, when indulgence to alcohol and assaults increases. Mandibular fractures also prevail in the month of July, which coincides with the rainy season in Haryana, India.

The most common cause of mandibular fractures analyzed in the present study was road traffic accident (48.83%), followed by assault (26.74%) and sports (13.95%), which contradicts the findings of Edwards et al. [6], Dongas et al. [32], Olasoji et al. [30], Adi et al. [31] and Ellis et al. [3]. These studies reported assault as the most common cause of fracture, the incidence rate being around 55%. The assault rates reported by Rix et al. (72.5%) in Sydney, Australia [23] and Asadi et al. (74%) in Manchester, United Kingdom, [33] are two of the highest ones. Both authors stated that the effects of social behaviour and alcohol, complicated by everyday stress of living in crowded city areas are associated with the increase in interpersonal violence. An earlier study, performed by Larsen et al. [34] in Denmark, showed that MVA (57%) were the most common causes of mandibular fractures, while assaults accounted for only 16%. The present study shows that the most common cause of maxillo-facial injuries was road traffic accidents, which is consistent with other studies, performed in developing countries [21,27,28,38]. These etiological differences reflect differences in the socio-economic factors, national infrastructure development (particularly roadways, traffic regulations and legislation) and other behavioral habits, such as alcohol consumption or criminal activities. The high number of maxillo-facial injuries attributed to RTA is explained by an inadequate road safety awareness; unsuitable road conditions without expansion of motorworks; violation of speed limit; old vehicles without safety features - such as antibursts locks and energy absorbing materials; failure to wear seatbelt or helmets; violation of the right of the way; violation of the highway code; use of alcohol or of other intoxicating agents; inexperienced, young drivers; behavioural disorders and socio-cultural insufficiency of some drivers.

Only 10% of the patients with mandibular fractures had an associated mid-facial fracture, 90% of them having only mandibular fractures. MVA represented the predominant cause of mandibular fractures associated with a mid-facial fracture, which agrees with the results of other studies [31,34].
The most common site of fracture in mandible evidenced by the present investigation was the paramedian one (23.25%), which is consistent with the findings of King et al. [10], who established a statistical significance between road traffic accidents and parasymphysis fractures. Atanasov [36] and Wong [37] reported that motorcycle accidents (79.5%) were the major cause of mandible fractures, with the parasymphysis as the most common site. Sunita Malik et al. [38] also founded parasymphysis as the most common site of fracture in the mandible. However, our study was not consistent with the findings of Adekeye [39], Nair [40] and Adebayo [41], who reported the body as the most prominent site, whereas Van Beek [42] found the condyle as the most common site, and Chalya et al. [43] stated the angle as the most prominent site of fracture.

The most common mandibular fracture combinations discussed in this study were angle/parasymphysis, followed closely by angle/body, frequently occurring as a result of assaults, with the mandible presumably fractured in more vulnerable areas. This finding is consistent with the observations of Dongas and Hall [32], who evidenced parasymphysis with angle, and contradicts the study of Abiose [44], in which the bilateral body was reported as the most frequent mandibular fracture combination. However, in that study, RTA appeared as the most common cause, similarly with the findings of our study. Ogundare et al. [11] reported body with angle as the commonest combination.

Several treatments may be applied in maxillofacial fractures, the differences among them depending on many factors, such as costs, patient's affordability, conditions in the hospital, doctor's decision and skill, patient's willingness to obey the treatment - all of them varying from one country to another. Most of the patients treated in our hospital benefited from closed reduction with arch bar fixation, and only few of them had open reduction and internal fixation, which is consistent with the studies conducted by Kamulegeya et al. [21], Chandra [45], Erol et al. [46], Kilasara et al. [47] and Sunita Malik et al. [38]. Open reduction and internal fixation has been reported to be the “gold standard” of the treatment of maxillo-facial fractures. However, this form of treatment has not become popular in our country due to lack of expertise (i.e. maxillo-facial surgeons) and to the reduced facilities for open reduction and internal fixation; even when available, the cost of the treatment is usually prohibitive.

The average length of hospital staying (LOS) registered in our study (10.12 days) was shorter than that reported by Martins Junior et al. [48], Chalya et al. [43], Sunita Malik et al. [38]

5. CONCLUSIONS

Road traffic accidents (RTA) represented the major etiological factor of maxillo-facial injuries, with young adult males as their main victims. The high number of trauma victims with maxillo-facial injuries evidenced in the present study highlights the importance of the Dental Surgery unit, besides the other disciplines assuring an emergency management of trauma victims. This study also evidences the importance of cooperation and coordination among the various medical disciplines, for a rapid management of maxillo-facial injuries, and not only, which might prevent functional as well as aesthetic morbidity.

References


