

Aetiology and Distribution of Mandibular Fractures in the National University Hospital, Singapore

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Abstract

Sixty-seven consecutive mandibular fractures treated mainly in 1998 were surveyed retrospectively. Treatment was performed at the National University Hospital, Singapore. Males outnumbered females by 5:1, with Chinese the commonest racial group involved (56.7%). Most patients were between 20 and 29 years of age. Road traffic accidents formed the largest proportion (61.2%) followed by industrial accidents and assaults. The symphyseal and parasymphyseal regions were most commonly fractured (46.5%). Almost a third of the patients sustained other facial fractures. Treatment was commonly administered within one to two days of discovery of the fracture and open reduction was the treatment plan of choice in 79.1% of the time. Discussion on how aetiology affects the fracture pattern in Singapore is carried out.

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Introduction

Apart from the nasal bone, the mandible is the most commonly fractured bone in the face. It is also the 10th most often broken bone in the body. The aetiology of this fracture varies from different hospitals, depending on the areas they serve. The National University Hospital serves the Western sector of Singapore which has primarily industrial estates, although pockets of residential housing are present. In the past year, 67 cases of fractured mandibles were treated in this hospital. This compares favourably with data from other centres around the world.¹⁻⁶

We present a retrospective review of the cases seen in the past year at this hospital. It is hoped that this data will be useful as a base-line, to study future trends and to identify areas where preventive measures are possible.

Materials and Methods

Sixty-seven consecutive patients with mandibular fractures were treated at the National University Hospital from October 1997 to December 1998. Patient information was retrieved from two computer databases in the

Departments of Oral and Maxillofacial Surgery and Plastic Surgery. In both cases, data were manually entered immediately or soon after the time of operation. All data were reconfirmed with patient's case-notes prior to publication. Where possible, data were reconfirmed with patient's radiographs and computed tomographic (CT) scans.

Data were recorded and analysed with respect to age, sex, race, aetiology, location of fractures, other facial fractures, methods of treatment and timing of operations. Due to the short period of review, no long-term outcome could be determined.

Results

Patients' age ranged from 2 to 79 years. The youngest was a passenger involved in a car accident, and the oldest, an elderly gentleman who sustained a fall. The mean and median ages were 29 and 26 years, respectively. Due to the fact that there was only 1 patient under 15 years of age, the median (26 years) would appear to be a more accurate representation of the trauma population. Most of the patients (49%) were aged between 20 and 29 years and males (83.6%) outnumbered females in

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the ratio of 5:1 (Table I).

The racial distribution was also analysed. The majority of patients were Chinese (56.7%) followed by Malays (20.9%), Indians (13.4%) and other races (9%). Apart from a single Caucasian female, patients in the category of 'other races' consisted predominantly of male Thai nationals (5 patients). Of the Indian patients, the majority was Indian and Bangladeshi nationals (7 of 9 patients) (Table II).

The different aetiological factors were divided into eleven groups (Table III). The chief cause of mandibular fractures was road traffic accidents (61.2%). This category was further subdivided into six separate sections for detailed analysis. It was found that motorcyclists (34.3%) contributed the most to the fracture figures. Industry-related accidents (18%) were a distant second place. Assaults and car passenger injuries (10.5%) were joint third. Males were more likely to be involved in all categories.

The 67 patients had 97 fractures in total with no significant differences between both left and right sides. The location and percentage distribution are illustrated in Figure 1. Most of the fractures were located in the parasymphyseal (31%) regions and the condylar process (27%). Symphyseal fractures were also relatively common (15.5%). It is interesting to note that the total number of fractures in the anterior mandible was close to half the number of mandibular fractures.

Single fractures in the jaw were seen most often [42 (62.7%)]. Two fractures occurred in 20 cases (29.8%) and 5 patients had 3 fractures (7.5%) (Table IV). In single

fractures, the common area traumatised was symphysis or parasymphysis. This pattern was slightly altered in those patients with two or more fractures. In these cases, the condyle and contralateral parasymphysis were most often involved.

Twenty-one patients (31.3%) had other facial fractures (not including nasal bone fractures). This is shown in Table V. Commonly, maxillary, zygomatic, nasoethmoidal, orbital and frontal bone fractures were associated. Not unexpectedly, a large majority (in excess of 95%) of patients with multiple fractures experienced high-velocity trauma, namely industrial-type falls, industrial accidents and road traffic injuries.

TABLE III: DISTRIBUTION OF MANDIBULAR FRACTURES BY AETIOLOGY

Aetiology	Male (%)	Female (%)	Total (%)
Road traffic accident			
Motorcyclist	20		20 (29.9)
Motorcyclist – Pillion	-	3	3 (4.5)
Car – Driver	4	1	5 (7.5)
Car – Passenger	4	3	7 (10.4)
Cyclist	3		3 (4.5)
Pedestrian	2	1	3 (4.5)
Industrial			
Accident, Explosion	9		9 (13.4)
Fall from a height			3 (4.5)
Altercation	6	1	7 (10.4)
sports	2		2 (3.0)
Domestic fall	3	2	5 (7.5)
Total	56 (83.6)	11 (16.4)	67 (100)

TABLE I: AGE AND SEX DISTRIBUTION OF MANDIBULAR FRACTURES

Age (years)	Male (%)	Female (%)	Total (%)
Younger than 20	10	1	11 (16.4)
20 to 29	28	5	33 (49.2)
30 to 39	13	1	14 (20.9)
40 to 49	3	1	4 (6.0)
50 to 59	1	1	2 (3.0)
Older than 60	1	2	3 (4.5)
Total	56 (83.6)	11 (16.4)	67 (100)

TABLE II: RACIAL DISTRIBUTION OF MANDIBULAR FRACTURES

Race	Male (%)	Female (%)	Total (%)
Chinese	31	7	38 (56.7)
Malay	11	3	14 (20.9)
Indian	9		9 (13.4)
Others (Thai)	5		5 (7.5)
Others (Caucasian)		1	1 (1.5)
Total	56 (83.6)	11 (16.4)	67 (100)

TABLE IV: DISTRIBUTION OF MANDIBULAR FRACTURES BY ANATOMIC LOCATION

Location	Total (%)
Single fractures	
Parasymphyseal	15 (22.3)
Symphyseal	10 (14.9)
Condyle	8 (11.9)
Angle	4 (6.0)
Body	5 (7.5)
Two fractures	
Parasymphyseal and contralateral condyle	8 (11.9)
Parasymphyseal and contralateral angle	4 (6.0)
Parasymphyseal and body	1 (1.5)
Body and condyle, coronoid or angle	3 (4.5)
Symphyseal and condyle, ramus or angle	3 (4.5)
Bilateral condyle	1 (1.5)
Three fractures	
Bilateral condyle and symphyseal or body	3 (4.5)
Bilateral angle and parasymphyseal	1 (1.5)
Angle, parasymphyseal and coronoid	1 (1.5)
Total	67 (100)

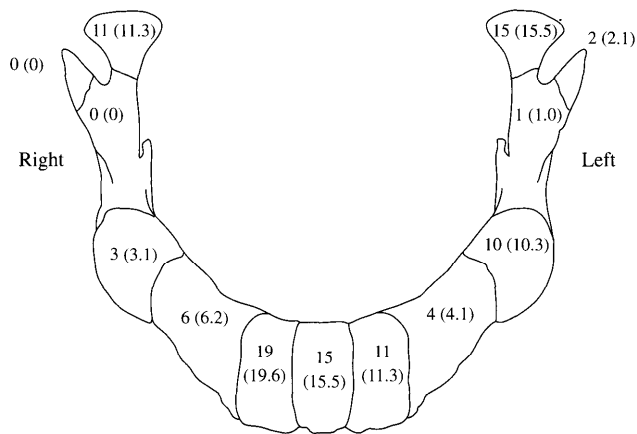


Fig. 1. Diagram showing the distribution of mandibular fractures (total 97 fractures) Percentages are enclosed in parentheses.

TABLE V: ASSOCIATION OF MANDIBULAR FRACTURES WITH OTHER FACIAL FRACTURES

Aetiology	Mandible only (%)	Other facial bones (%)
Road traffic accident		
Motorcyclist	11 (16.4)	9 (13.4)
Motorcyclist – Pillion	3 (4.5)	
Car – Driver	4 (6.0)	1 (1.5)
Car – Passenger	6 (8.9)	1 (1.5)
Cyclist	3 (4.5)	
Pedestrian	2 (3.0)	1 (1.5)
Industrial		
Accident, Explosion	3 (4.5)	6 (8.9)
Fall from a height	1 (1.5)	2 (3.0)
Altercation	6 (8.9)	1 (1.5)
sports	2 (3.0)	
Domestic fall	5 (7.5)	
Total	46 (68.7)	21 (31.3)

Fourteen cases (20.9%) were treated conservatively, either with closed reduction techniques or with observation and placement on soft diet. The rest (79.1%) were treated with open reduction and osteosynthesis (internal fixation using titanium mini plates and screws) (Table VI). It is common practice in both our Departments to place the plates intraorally or through external lacerations. As previously mentioned, long-term results are not available.

The lag time between admission and intervention (surgery or closed reduction) varied from less than a day (35%) to 15 days post admission (1.7%). The average time before intervention was 2.8 days. Due to few cases of delayed intervention which shift the values up, the average is better represented by the median which is one day post-admission (Fig. 2).

Discussion

There are numerous papers in the literature describing

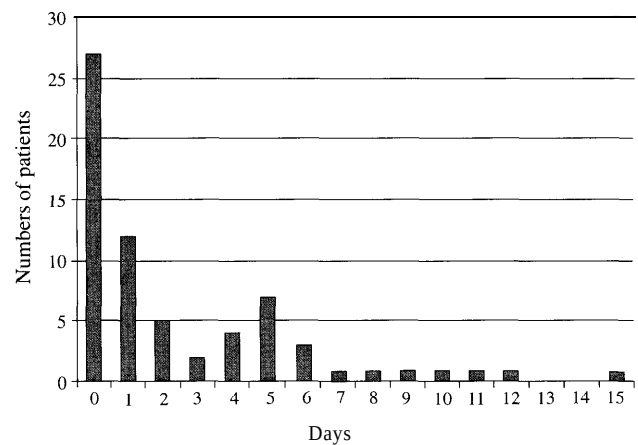


Fig. 2. Time between diagnosis and intervention of mandibular fractures.

TABLE VI: METHODS OF TREATMENT OF MANDIBULAR FRACTURES

Methods	No. (%)
Open reduction and internal fixation	53 (79.1)
Closed reduction (intermaxillary fixation)	7 (10.45)
Observation	7 (10.45)
Total	67 (100)

patterns of facial and jaw fracture.¹⁻¹⁴ The results of these studies, especially when related to aetiology, vary greatly from institution to institution. There are however, few recent reports of such nature from Asian countries.² Most of the studies also examine relatively large population samples over long periods of time.^{2,6,7,12} After adjustment for the duration of the studies however, the number of cases ranged from 24 patients¹⁴ to 213 patients⁷ per annum. Many of which were between 30 to 70 patients treated per year.¹⁻⁶ Furthermore, patients with fractures limited to the alveolar process of the mandible were included, unlike that in the present study.⁷ Therefore in terms of numbers per annum, the cases in this series is comparable to those in the international literature.

Males were predominant in our sample (83.6%) and this correlates well with findings from previous groups.^{1,4,6,7-10,15} Male to female ratios have been reported to vary between 3:1 and 16.9:1.^{12,15} Published data suggest that men outnumber women. Our ratio of 5:1 is high but not too dissimilar. This is probably due to the large proportion of road traffic and industrial type accidents seen in our sample.

The predominant age group was between 20 and 29 years of age (49%). This is similar to studies from other countries.¹⁻¹⁰

Due to the location of the hospital and the nature of the

surrounding industrial area, an interesting finding was noted. Foreign workers formed a relatively large proportion of mandibular fracture patients (28%). These workers formed three-quarters of the patients involved in industrial-related accidents and more than half (57%) the number in altercations (data not shown in tables). Although our sample size is not large enough to draw firm conclusions, it may be a developing trend worth observing. To our knowledge, there are no studies that point out similar parallels.

The most common causes of fractures in other countries vary from assaults and war (United Kingdom, Australia and Africa)^{4,7,8,10,15} to road traffic accidents (Middle East and Japan).^{2,16} Specific sporting activities such as cycling, rugby and skiing may have effects on distribution of fractures.^{6,11,17} The nature of the directed force resulted in very different patterns of injury. Allocations and falls from low elevation are invariably low-velocity injuries. The mandible is expected to break at anatomically "weaker" areas such as the angle, parasymphysal and condyle.¹⁸⁻²¹ High-velocity injuries, such as road traffic accidents, produce greater comminution, affect a greater number of facial bones and damage is most likely to occur directly at the point of impact.^{7,12,21} For car users, it has been shown in other countries that the fracture incidence is reduced with the implementation of safety belts.^{13,22,23} With mandatory seat belt laws in Singapore, car occupants have a reduced risk and motorcycle-related fractures rise into prominence. Thirty-four per cent of mandibular fractures are associated with motorcycles compared to 18% for car users (Table III). Almost half of injuries sustained by motorcyclists were associated with multiple facial fractures (Table V).

There are two basic types of helmets available in the market. These are categorised as full-face and open-face depending on whether there is an extension of the helmet covering the lower jaw. It would be of interest to note if full-face helmet wearers have any significant difference in fracture pattern. The helmet, however, was not able to prevent almost half (45%) of the motorcyclists from injury to more than one facial bone (Table V). Further effort should be made to identify the factors responsible for these injuries and possible means of prevention.

Treatment depends on the severity of the injury and the preference of the surgeon. With badly displaced fractures and the advantage of early oral diet, open reduction is the treatment of choice.²⁴ It is also helpful to reduce and stabilise the mandible as part of the outer facial frame for reduction of associated maxillary fractures. After plating, it is common to place our patients on a period of intermaxillary elastic traction in the initial healing phase, although this is not absolutely necessary.^{25,26} In our experience, open reduction and internal fixation were carried out on 79.1% of patients at our

hospital. This is a greater percentage than quoted by other studies.^{1,2,4,7} A possible explanation is that retrospective studies of long duration tend to reflect trends from the past. Of the remaining patients, an equal number were treated with closed reduction (intermaxillary fixation) and observation. At present, it is not possible to know the long-term success with this protocol.

The lag time between admission and management of the fracture is dependent on logistics as well as the state of the patient. The mandibular fracture is considered semi-urgent and has to make way for cases that need emergency intervention. Furthermore, for patients unstable with severe polytrauma, delays were sometimes unavoidable (up till 15 days post-admission). However, it is common practice to treat fractures as soon as possible and the median value of one day post-admission is confirmation of this fact.

In conclusion, based on this preliminary study, a patient with mandibular fractures in the National University Hospital is most likely to be a male, Chinese motorcyclist between 20 and 29 years of age. Open reduction is most commonly performed and usually within a day of diagnosis. Further research should be carried out in the direction of assessment of treatment outcome, together with a possible way to reduce the severity of mandibular trauma in motorcycle accidents.

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