Original research

A detailed analysis of mandibular fractures epidemiology, treatment and outcomes: A 5-year retrospective study, Gansu Province-China

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ABSTRACT

Purpose: The aim of the study is to comprehensively analyze the clinical epidemiology of the mandibular fracture including several factors which could affect the incidence, treatments, and outcomes of the mandibular fracture.

Materials and methods: A retrospective study was conducted to include the patients with mandibular fractures in the department of maxillofacial surgery of the Lanzhou University second hospital from 2011 to 2015. The predictor variables were age, gender, ethnicity, medical health, habits, etiology, and treatment methods for mandibular fracture. The outcome variables were postoperative complications of MFs and corrective revision surgeries. T, Chi-square, Fisher's exact, and Spearmen statistical tests were used to analyze the data.

Results: There were 342 patients with 571 fractures. Male/female ratio was 4.1:1 with the third decade accounted for (30.1%). Traffic accidents (43.6%) were the most common etiology followed by falls (31.6%). Symphysis/parasymphysis (26.4%) and condyle (24%) were the most common fracture sites. The complication rate was 18.4% with the infection (8.8%), and malocclusion (5.8%) were the most frequent complications. The rate of secondary operation was (5%). A high time interval to repairing was detected (mean = 11.04) without statistical significance between the rate of the overall complications and time interval to repairing (P = 0.957). Compromising factors significantly increase the rate of infection. There was no significant difference between the administration of antibiotics and the incidence of infection (P = 0.289).

Conclusion: A well understanding of the epidemiology of mandibular fracture and variables' correlations is clinically important in advancing the prediction, diagnosis, treatment, and prevention of mandibular fractures in a particular population. Potential risk factors such as trauma severity, compromised medical health, and patient's behaviors were significantly affecting the resultant outcome. Open reduction and internal fixation of condyle fracture resulted in constant occlusal result than closed one. An antibiotic therapeutic effect against infection in mandibular fractures remains suspected. Time elapsing from injury to treatment had no influence on the overall complications.

1. Introduction

Mandibular fractures (MFs) are one of the most common types of the maxillofacial trauma, and occur as twice as maxillofacial trauma. A proper management of the MFs aimed to reconstruct anatomy, function and esthetic, thereby preventing the deteriorating effects to the patients [1–4].

The demography, socioeconomic status of the population and the study conducting period are mainly affecting the incidence and the mechanisms of injury of mandibular fractures from country to

another or even in the same country. However, some of the epidemiological studies showed relatively comparable results [1–14].

The assaults and road traffic accidents (RTAs) have been accounted for the most common causes of MFs [3,5,6,8,9,13,14]. Falls usually come as the second most common and sports in some European countries [1,10,11,15]. Furthermore, there is a decline in the road traffic accidents with an increase in assaults in the developed countries due to alcohol and drug addiction and economic crises [1,12,16,17].

Serious clinical, epidemiologic evaluation of the population including demographic data, etiology and time is necessary for the potential preventive measure, identifying the targets and overcoming the incidence. Furthermore, understanding of the association between the mechanisms of the injury and the location of the mandibular fracture can appreciably assist the surgeons in the prediction and diagnosis of mandibular fracture [1,3–5,7,9,13].

Treatment for MFs appears to vary according to the surgeon's skills, available facilities, and patient's economic status and to some extent patient's preference. However, it is important that the treatment should be based on the type, location and severity of the mandibular fracture to fulfill satisfied outcomes [1,18]. Osteosynthesis of MFs with Titanium miniplates has been extensively used following the modification of the Michelet's technique by Champy in 1976 and later became recommended by the Association for osteosynthesis/Association for the study of internal fixation (AO/ASIF) [8,18,19]. Although there is an improvement in the plating system and advancement in treatment methods of the MFs, postoperative complications are still common [15,20]. Several factors can influence the incidence of the complications following MFs repair, including inappropriate treatment plan, the technique used, patient's medical status, substance abuse, type of fracture, fracture numbers, fracture location, concomitant injuries, interval to the repair and patients' noncompliance.

Despite the presence of many trends concerning the epidemiology of MFs in various countries, there is no documented data reporting on the clinical epidemiology of MFs in China. This is the first clinical epidemiological study of MFs in China. Thus, the purpose of this study was to analyze the clinical epidemiology of MFs, including the distributions, patterns of fractures, mechanisms of injury, treatments used, outcomes and factors affecting the outcomes.

2. Materials and methods

The authors designed and implemented a retrospective cohort study and enrolled a sample derived from a population of patients who came to the Department of Oral and Maxillofacial Surgery, Lanzhou University 2nd hospital over a five-year period (January 1, 2011–December 1, 2015), using a standardized departmental database and medical records. The Medical Ethical Committee of Research Institute/Lanzhou University Second Hospital approved this study.

The inclusion criteria were all age-group patients who had MFs with or without associated maxillofacial and other body fractures. The exclusion criteria were any patient with incomplete information and those who received primary surgical treatment of MFs in other centers.

Variables regarding age, sex, race, medical status, the habit of smoking and drinking, and date of hospitalization, date of trauma, treatment time and hospital discharge date were recorded. The etiology, anatomical site of the fracture and associated maxillofacial and non-maxillofacial fracture were also included.

The treatment variables were closed treatment, open reduction with internal fixation and antibiotics uses. Detailed information of the associated postoperative complication and early secondary

Table 1
Correlation between sex and most common etiologies.

Etiology	Gender		Total (%)
	Males (%)	Females (%)	
RTAs.	120 (80.5)	29 (19.5)	149 (100)
Falls	84 (77.8)	24 (22.2)	108 (100)
Assaults	52 (83.9)	10 (16.1)	62 (100)
Total	256 (80.3)	63 (19.7)	319 (100) $P = 0.663$

treatment/revision during the six postoperative months was also assessed.

The attending surgeon performed the preoperative, postoperative, and follow-up examinations with the diagnosis based on the clinical and radiographic examination. In addition to the medical charting, the Patients' preoperative and postoperative radiographs (Panoramic, 3D computed tomography, CT scan tomography, cone beam computed tomography or plain radiograph) had been reviewed by the assessors to confirm the type and region of the fracture as well as the presence of mandibular third molar.

SPSS version 23 was used for data interpretation and statistical analysis using T-test, Chi-square and Fisher's exact tests. Spearmen test was also used to investigate the correlation between the time interval and the incidence of complication. P value <0.05 regarded statistically significant.

3. Results

342 patients with 571 MFs were gathered in this study with a mean of 1.669 ($\pm$0.6927) fracture per mandible. Males accounted for (80.4%, $n = 275$) while females accounted for (19.6%, $n = 67$) of the study population, with male/female ratio of 4.1:1. The patient age ranged from a year to 76 years (mean 29.9 ± 14.133). The peak incidence of MFs in both genders was between the age of 21–30 years (30.1%). Patients up to 40 years of age accounted for approximately 75% of the study population.

Six Ethnic groups were presented in this study with the Han as the highest percent (81%, $n = 277$), followed by Tibetan (7.3%, $n = 27$), Hui (6.7%, $n = 23$), and Dongxiang (4.4%, $n = 15$). Ban and Tu presented with a very low percentage (0.3%, $n = 1$ for each group).

The months of July and August revealed a high incidence rate (22.5%, $n = 77$) while, the year of 2012 yield the lowest percentage of MFs (17.8% $n = 63$) and the incidence increased to (23.7%, $n = 81$) in 2015. No statistical differences had been detected among the yearly and monthly distributions when using the nonparametric test.

149 (43.6%) patients sustained MFs which resulted from RTAs (100 (29.2%) Car accidents, 40 (11.7%) motorbikes, and 9 (2.6%) bicycles), followed by falls (31.6%, $n = 108$), and assaults (18.1%, $n = 62$). RTAs and falls were the most common cause of MFs followed by assaults in males and females with no significant correlation between the sex and etiology. Meanwhile, work-related accidents were restricted to men. Falls down were significantly high in children under 13 years and elderly patients above 50 years ($P < 0.001$) (Tables 1 and 2).

The mandible symphyseal/Parasymphyseal areas accounted for (26.4%) of the fractured areas, followed by the condyle (24%) (Fig. 1). In patients with single mandibular fractures, symphysis/parasymphysis was the most common site followed by the condyle. On the contrary, in the case of multiple MFs, the condyle accompanied with the symphysis/parasymphysis yield the highest numbers followed by the condyle and body areas. More than (56.4%) of the patients had multiple fractures, most being two (47.7%) sites followed by three (7.6%), four (.6%) and five (.6%) sites. Fractures on the left side (37.3%, $n = 213$) were relatively more than