

A Review of Mandibular Fractures in a Craniomaxillofacial Trauma Centre

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Abstract

This report is a retrospective review of 74 cases of mandibular fractures managed in a craniomaxillofacial trauma centre between January 1994 and May 1998. Demographic data revealed that 85% of the patient population were male, with a mean age of 27.5 years. The commonest causes of injury were motor vehicle accidents (48.6%), followed by assault (16.2%) and accidental falls (17.4%).

In 25 patients (33.8%) the fractures were single. Of these, fractures of the condylar region were the most common (8 patients). The remaining patients sustained fractures in two or more anatomic sites. There were other associated facial fractures in 45.9% of patients. Trauma to other systems was present in 37.8%, with orthopaedic and neurosurgical injuries being the most common.

Surgical management in the form of open reduction and internal fixation was carried out in 61 patients (82.4%). Maxillo-mandibular fixation was used as an adjunct to maintain occlusion and bony reduction in unstable and comminuted fractures (15 patients, 20.3%), and as the primary mode of treatment in patients with stable, undisplaced fractures, particularly condylar fractures, in which the pretraumatic occlusal relationship was not disrupted (9 patients, 12.2%). A successful outcome was defined as a stable and healed fracture, with restoration of functional occlusion, facial symmetry and facial aesthetics. Complications observed included temporomandibular joint dysfunction (10.8%), malocclusion (9.5%), infection (8.1%), implant exposure (5.4%), and non-union or delayed union (4.1%).

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Introduction

The mandible occupies a unique position in the facial skeleton, being both the aesthetic and functional foundation of the lower third of the face. Its prominence makes it particularly susceptible to trauma, and it is one of the most commonly fractured facial bones.¹⁻³ While the immediate priorities in the management of patients with mandibular fractures are airway maintenance and the treatment of life-threatening injuries, subsequent goals are the re-establishment of the pretraumatic occlusal relationship, and restoration of facial symmetry and aesthetics. Unlike fractures of the middle and upper face, fractures of the mandible are subjected to strong biomechanical forces, and are frequently associated with contamination from oral secretions. Mandibular fractures therefore pose unique and challenging problems to the craniomaxillofacial surgeon.

This investigation reviews the epidemiology, treatment, outcomes and complications in patients with

mandibular fractures treated at the Department of Plastic Surgery, Singapore General Hospital, from January 1994 to May 1998.

Materials and Methods

The hospital records of 85 consecutive patients with mandibular fractures treated by the senior authors (CLF, MHS and VKLY) were reviewed. The patients were managed at the Department of Plastic Surgery, Singapore General Hospital between January 1994 and May 1998. Data were obtained from the patient's files and imaging films, which included age, sex, aetiology, anatomic sites and fracture patterns, associated facial trauma and injuries to other systems, mode of treatment, outcomes and complications.

Results

Among the cohort of 85 patients, 11 patients were excluded because of inadequate follow-up. The remain-

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ing 74 patients formed the basis of the study. Sixty-three patients were male (85%). The mean age was 27.5 years (range 13 to 49 years). Road traffic accidents were the most common cause of injury (48.6%), followed by assaults (16.2%) and falls (17.6%) (Table I). Less common causes included industrial accidents and sports.

Twenty-five patients had fractures of a single anatomic site. Among these patients, the most common fracture site was the condylar region, which was involved in 8 patients (32%). Other common sites of injury were the mandibular angle and the parasymphyseal region (Fig. 1). The remaining 49 patients had multiple fractures of the mandible. In 14 of these cases (29%), segmental patterns of injury occurred as a result of direct trauma. The majority of these cases were high velocity injuries resulting in a comminuted pattern of fracture. The remaining 35 patients with multiple fractures of the mandible (71%) sustained body or parasymphyseal fractures with associated contralateral angle or condylar fractures. These patterns are postulated to arise as a result of direct localised trauma, with transmission of forces indirectly causing the contralateral fracture (Fig. 2).

Thirty-four patients (45.9%) had other associated facial fractures (Table II). Dento-alveolar injuries were present in 19 patients (25.6%). Twenty-eight patients (37.8%) had associated polytrauma (Table III).

Open reduction and internal fixation was the main-

stay of treatment and was performed in 61 patients (82.4%). Maxillo-mandibular fixation was used as an adjunct to maintain occlusion and bony reduction in unstable and comminuted fractures (15 patients, 20.3%). It was the primary mode of treatment in 9 patients (12.2%). These were patients with stable, minimally displaced or undisplaced fractures, particularly condylar fractures, in which the pretraumatic occlusal relationship was not disrupted. Four of these patients were treated conservatively (5.4%, Table IV).

Follow-up of patients ranged from 1 to 29 months, with a mean duration of 6.2 months. Successful outcome was defined as a stable and healed fracture, with restoration of pretraumatic occlusion, facial symmetry and aesthetics, and normal temporomandibular joint function. Restoration of pretraumatic occlusion was achieved in 67 patients (90.5%). Satisfactory temporomandibular joint function, as defined by absence of pain or clicks, with a satisfactory range of motion, was observed in 66 patients (89.2%). Good facial aesthetics were obtained in 72 patients (97.3%, Table V).

TABLE I: AETIOLOGY OF MANDIBULAR FRACTURES

Aetiology	No.	%
Vehicular accidents	36	48.6
Assaults		
Sharp	2	2.7
Blunt	10	13.5
Falls	13	17.6
Industrial accidents	11	14.9
sports	2	2.7
Total	74	100

TABLE II: ASSOCIATED FACIAL FRACTURES

	No.	%
Incidence	34	45.9
Distribution:		
Dento-alveolar	19	25.6
Orbito-zygomatic	14	18.9
Midface	11	14.8
Pan-facial	4	5.4
Naso-orbito-ethmoid	1	1.3

TABLE III: ASSOCIATED POLYTRAUMA

	No.	%
Incidence	28	37.8
Distribution:		
Musculoskeletal	19	25.7
Intracranial	12	16.2
Thoracic	6	8.2
Abdominal	3	4.1
Ocular	2	2.7

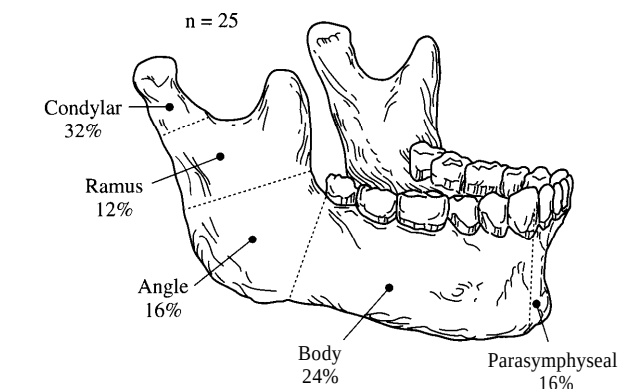


Fig. 1. Single fractures of the mandible showing distribution by site of fracture

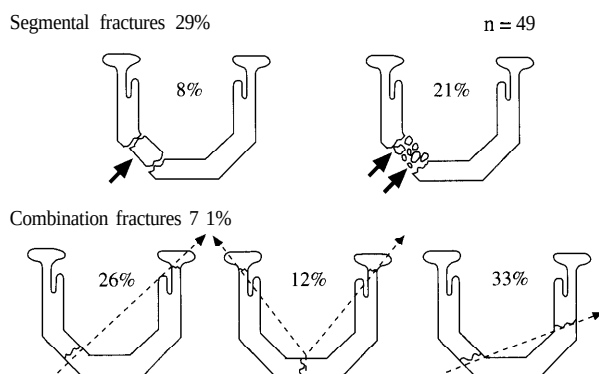


Fig. 2. Multiple fractures of the mandible.

We observed an overall complication rate of 25.7% (19 out of 74 patients). Malocclusion was observed in 7 patients (9.5%). Three of these patients required re-operation to restore occlusion, while the remaining 4 were mild and successfully corrected by postoperative orthodontics. Temporomandibular joint dysfunction, with pain, clicks or restricted mouth opening (defined as a maximal interincisal distance of less than 4 cm), was recorded in 8 patients (10.8%). Seven patients were noted to have numbness of the chin and lower lip pre-operatively. However, on follow-up, these symptoms had resolved in all but 3 of these patients (4.1%). These were patients in whom the fractures were comminuted fractures of the body of the mandible. Additional complications such as infection, non-union and implant exposure, occurred in a small number of patients (Table VI).

Discussion

It should be noted that the figures reported here are not representative of the true incidence of fractures of the mandible seen at the Singapore General Hospital. The main reason for this is that patients with mandibular fractures seen at the Accident and Emergency Depart-

ment may be referred either to the Dental Service or to the Plastic Surgery Service for subsequent management, with no strict protocol defining to which service a given patient will be referred.

In the present series, road traffic accidents were the most common cause of injury. This is in contrast to other reports, especially those from urban centres,^{4,5} in which violence and assaults were the most common causes. Thorn et al⁶ reporting on the incidence of mandibular fractures in Greenland, noted that the aetiology was interpersonal violence in 90% of cases.

We also observed a higher incidence of other associated facial fractures (45.9% of cases) and trauma to other systems (37.8% of cases). This may reflect the relative frequency of high velocity injuries such as road traffic accidents and falls, compared to the more localised trauma seen with violence and assaults. It may also be indicative of a bias in referral patterns, as there is a tendency for patients with isolated mandibular fractures to be referred to the Dental Service, while patients with co-existing fractures of other parts of the face and associated polytrauma tend to be referred to the Plastic Surgery Service. Other authors have reported similar trends, with polarisation of fracture patterns managed, depending on subspecialty.⁷

The majority of fractures (82.4%) were managed by open reduction and internal fixation. Early stabilisation of the mandibular fracture avoids a prolonged period of maxillo-mandibular fixation with its attendant complications such as inadequate oral intake, poor oral hygiene, discomfort and temporomandibular joint dysfunction secondary to prolonged immobilisation.^{8,9} Rigid fixation is also a useful technique for patients who may be subjected to poor follow-up. In our centre, maxillo-mandibular fixation as the primary mode of treatment is generally reserved for patients with stable, undisplaced fractures, particularly condylar fractures, in which the pretraumatic occlusal relationship is not disrupted. The high proportion of fractures treated by operative reduction and fixation also reflects the high incidence of multiple facial fractures and polytrauma, in which case even greater benefit can be derived from early stabilisation of the fracture, particularly in terms of facilitating airway management and ensuring adequate oral intake.

The complication rate of this series was compared with figures from other reports. Our overall complication rate of 25.7% falls within the high end of the range compared with that of other series, which ranges from 7% to 26.9%.^{4,10} We believe several factors are responsible for this. First, the problem of postoperative temporomandibular joint dysfunction (TMJ) dysfunction is often ignored in other published series,^{4,11} and is probably under-reported in general. However, it was evaluated in our study, and included as instances of TMJ dysfunction

TABLE IV: MANAGEMENT

	No.	%
ORIF	61	82.4
MMF only	9	12.2
Conservative	4	5.4
Total	74	100

ORIF: open reduction and internal fixation; MMF: maxillo-mandibular fixation

TABLE V: OUTCOMES

	No.	%
Restoration of :		
TMJ function	66	89.2
Pretraumatic occlusion	67	90.5
Facial aesthetics	72	97.3

TMJ: temporomandibular joint

TABLE VI: COMPLICATIONS

	No.	%
Overall complication rate	19	25.7
TMJ dysfunction	8	10.8
Malocclusion	7	9.5
Infection	6	8.1
Implant exposure	4	5.4
Sensory loss	3	4.1
Delayed/non-union	3	4.1

TMJ: temporomandibular joint

such features as pain, clicks and restricted mouth opening of less than 4 cm. Thus, TMJ dysfunction was recorded in 10.8% of cases (8 patients).

The incidence of malocclusion was 9.5% (7 patients). The majority of patients in this group were those who had multiple mandibular fractures or complex maxillo-facial fractures, where the restoration of occlusion is made even more difficult. This finding is consistent with the observation of Edwards et al¹² that there is a strong correlation between complication rate and fracture severity.

Our infection rate of 8.1% is comparable with that of other series. Busuito et al⁴ reported an overall infection rate of 8%, while Anderson and Alpert⁸ reported an infection rate of 16% in fractures which were rigidly fixed. While Thaller¹¹ reported a lower incidence of infection in patients treated with rigid fixation (2%) compared with those treated with maxillo-mandibular fixation (9%), Leach and Truelson¹³ found that the converse was true. However, in our series, the number of patients treated with maxillo-mandibular fixation alone was too few for any meaningful comparison to be made.

Conclusions

In this series of mandibular fractures a relatively high incidence of multiple facial fractures and polytrauma was observed. Because of this, the majority of patients were managed aggressively by early open reduction and internal fixation, with a tendency to rely less on maxillo-mandibular fixation in order to avoid its attendant complications. This approach has yielded good clinical outcomes with acceptable complication rates. The goals of treatment, namely restoration of functional occlusion, facial shape and contour, and normal temporomandibular joint function, present a surgical chal-

lenge. Craniomaxillofacial surgeons, who are trained to treat the entire range of facial fractures frequently encountered in the polytrauma patient, should play a central role in the management of these complex problems.

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