

ORIGINAL PAPERS

A Two Year Review Of The Treatment And Complications Of Mandibular Angle Fractures

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ABSTRACT

A review of all patients with treated mandibular angle fractures at a district general hospital, over a two year period, was undertaken. Forty one consecutive patients with 43 mandibular angle fractures were identified. Thirty eight fractures were treated by open reduction and internal fixation with miniplates and 5 by intermaxillary fixation (IMF).

Fractures treated with miniplates were reduced under direct vision to give an anatomical reduction without using temporary intermaxillary fixation. The shortened operative time together with the prompt administration of intravenous antibiotics following injury and rapid treatment of fractures after admission resulted in a low complication rate of 7.3% of patients requiring a subsequent surgical procedure. Although IMF has an important role to play in the general treatment of facial fractures, we suggest that there is a place for single miniplate fracture fixation without the use of temporary IMF when treating simple angle fractures. As this technique is quick and has a low complication rate its use in military situations should be considered.

Introduction

Mandibular angle fractures have the highest complication rate of all mandibular fractures (1). To minimize complications, anatomical reduction of the fracture is required together with functionally stable fixation, an atraumatic technique and immediate active function (1). In a comprehensive review of trials Ellis (2) concluded that single miniplate fixation of mandibular angle fractures was associated with the fewest complications. However, even this technique had a 16% complication rate where patients required a further surgical intervention.

In war 16% of battlefield injuries are to the head and neck (3). Blunt trauma and low energy transfer ballistic trauma is common and result in linear fractures of bone such as mandibular angle fractures. These injuries are similar to those sustained by civilians in contact sports and in assaults. In battlefield casualties, providing the airway is secure, simple mandibular fractures take low surgical priority. However, simple compound

fractures of the mandible often heal better if treated early (4). Therefore, military surgeons treating these fractures should use the quickest and simplest techniques in order to achieve the best outcomes without unnecessary waste of valuable theatre time.

To investigate if mandibular angle fracture treatment modalities and complications at the Royal Gwent Hospital were in keeping with published literature a review of successive patients treated over a two year period was performed. In addition, the application of techniques to military practice was assessed.

Patients and methods

The case notes of all patients with mandibular angle fractures managed operatively at the Royal Gwent Hospital between October 1998 and October 2000 were retrospectively reviewed. Data was collected on demographics, nature of fracture, the timing of injury, admission and surgery, antibiotic administration, method of treatment, outcomes and complications.

Results

A total of 41 patients with 43 mandibular angle fractures were admitted and subsequently underwent surgery. Fractures were treated using IMF alone or by open reduction and internal fixation using 2.0mm miniplates and monocortical screws without temporary IMF.

The male to female ratio was 39:2, and the mean age was 26 years (range 16-50 years). Overall 71% of injuries were due to assaults.

The average time from injury to admission was 7 hours excluding two patients who presented 4 days and 3 weeks after injury (range 3 hours - 3 weeks). The average time from admission to operation was 14 hours (range 5-40 hours).

In total 66% of patients pre-operatively and 54% of patients post-operatively had no details of inferior alveolar nerve paraesthesia recorded in their notes.

Angle fractures were present on the left side in 64% of patients. A total of 26 patients had other associated mandibular fractures. In this subgroup, 46% of patients had a fracture in the right parasymphysis, the most common associated site of fracture.

A third molar was present in the fracture line in 90% of the angle fractures and 84% of the third molars were removed at the time of primary fracture fixation.

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Fractures were treated by 2 consultants, 2 non-consultant career grades and a registrar. Five patients were treated solely with IMF, 2 of which had bilateral angle fractures. In total, 36 patients underwent open reduction and internal fixation. Miniplates were positioned on the external oblique ridge alone in 23 patients with one patient developing an infection. Eleven patients had miniplates placed solely on the lateral aspect of the mandibular ramus with no subsequent infections. In the 2 patients where miniplates were placed on both the external oblique ridge and the ramus, both cases were complicated by post-operative fracture infection.

All patients were treated on admission with intravenous antibiotics and then discharged home on an oral regime. Co-amoxiclav was used in 83% of patients.

Out of the 41 patients, 6 (15%) developed complications of which 3 (7.5%) required a further surgical intervention. One patient required surgical removal of a wisdom tooth and removal of the external oblique ridge plate at 4 weeks post operatively. A second patient, who had two miniplates placed, required incision and drainage of a retromolar abscess at 2 weeks. The external oblique ridge plate was removed electively at 8 weeks whilst the ramus plate was left in situ. The third patient, who also had two miniplates placed, required a further course of antibiotics at 1 week for local redness and a persistent pyrexia. The external oblique ridge plate was noted to be exposed and was removed with a bony sequestrum at 12 weeks post-operatively whilst the ramus plate was left in situ. In all 3 patients bony healing of the fracture site was noted.

The 3 patients who did not require surgery presented at follow up with a malocclusion. One patient was successfully treated with IMF using elastics. The other 2 patients were noted to have a mild occlusal discrepancy which was accepted by both patient and clinician.

Discussion

The low complication rate of 7.5% requiring further surgical intervention in our study compares well with Ellis's review of studies from his unit where up to 32% of patients with angle fractures required admission to hospital to treat complications (2). However, direct comparison of studies from different units and countries is difficult as the aetiology of fractures, socio-economic status of patients, quality of post-surgical care and definition of complications may vary.

Several methods to treat mandibular angle fractures have been evaluated and two have been recommended as having the lowest complication rates (2). In the first a single miniplate with monocortical screw fixation, as described by Champy (5) is used. In the second a rigid reconstruction plate is placed

extra-orally. A higher infection rate of 12.9% has been reported when using intra-orally placed miniplates as compared with 2.3% when using extra-orally placed rigid reconstruction plates (6). However, patients treated via an extra-oral approach had a 7.9% incidence of weakness of the marginal mandibular branch of the facial nerve post-operatively. Most clinicians now reserve the reconstruction plate technique for complex or infected mandibular fractures where increased rigidity is required (1-7).

The incidence of 71% of injuries in the study being due to assault is consistent with other larger studies of mandibular fractures (8). Since 90% of the population are right handed, the 64% distribution of mandibular angle fracture site on the left side may be related to a blow from the assailant's dominant hand.

Paraesthesia associated with mandibular fractures was not well recorded in our study. In mandibular fractures paraesthesia of the chin and lower lip on the same side of injury is common. This is due to damage to the inferior alveolar nerve within the bone at the time of trauma but may be compounded by manipulation during fracture reduction. Therefore, adequate pre-operative and post-operative assessments of paraesthesia must be documented in the patient's notes for medico-legal as well as clinical reasons.

Patients with third molars present are 3.8 times more likely to sustain mandibular angle fractures with trauma than patients without mandibular third molars (9,10). In our study 84% of patients had the third molar tooth removed at the time of fracture fixation. Mobile teeth or teeth with apices in the fracture line should be removed (11). Nevertheless, the evidence for routine removal of third molars in the line of fracture is unclear. Rubin *et al* (12) also showed that third molar removal with open reduction and internal fixation gave fewer post-operative complications. In contrast Gerbino *et al* (13) showed a higher incidence of complications when the third molars were removed.

The majority of patients in our study attended hospital within 24 hours and all received intravenous antibiotics on admission. The prompt administration of antibiotics following trauma in adequate doses, with consideration of the bacteria likely to be contaminating the wound, is recommended to prevent infective complications (14). Furthermore, mandibular angle fractures treated by rigid fixation are more likely to become infected if fixed after 24 hours of injury (15). The average time from admission to surgery was 14 hours in our study and this may also have contributed to the low infection rates post-operatively.

Rigid fracture fixation is recommended for markedly displaced fractures or in alcoholics, as these cases are prone to complications (1). Two miniplates are often used to achieve

more stable fixation, but such cases where this is required are more likely to become infected. Hence, in our study the removal of plates for infection in both cases treated with 2 miniplates may have been due to patient selection rather than the technique of fixation. Ellis and Walker (11) showed increased rates of infection associated with the use of 2 miniplates but Schierle (16) showed no significant differences in rates of infection or in occlusal discrepancies, between the use of one or 2 miniplates in a randomised prospective study. In contrast, Levy *et al* (17) reported the lowest complication rate in their 2 miniplate group.

Temporary IMF is commonly used to assist in fracture reduction and support during plating. The majority of fractures treated at our unit were not placed into temporary IMF. The fractures were reduced and fixed under direct vision ensuring an anatomical reduction. The avoidance of the use of pre-operative IMF is economical in time and cost, is safer for the operator and more comfortable for the patient. Using this technique also produces fewer early post-operative complications (18). IMF has an important role to play as a quick and simple method of reducing and immobilising fractures, especially in military casualties. However, as our study indicates, the routine use of temporary IMF during definitive plating of mandibular angle fractures may be unnecessary.

To further investigate operation times where data was available, a separate group of patients treated over the period March 1999 to March 2000 was analysed. The mean operative and anaesthetic time for angle fractures treated by open reduction and miniplate fixation without IMF was markedly less at 78 minutes in comparison to 170 minutes with IMF.

Conclusive evaluation of treatment modalities of angle fractures requires prospective trials with adequate numbers for statistical analysis. However, in light of the low complication rates achieved in our study we suggest that there is a place for single miniplate fracture fixation of mandibular angle fractures without the use of IMF. Furthermore, as this technique also saves valuable theatre time its use in military situations should be considered.

References

1. Prein J. AO Manual of internal fixation in the facial skeleton. Berlin. Heidelberg. New York: Springer-Verlag 1998.
2. E Ellis III: Treatment methods for fractures of the mandibular angle. *Int. J. Oral Maxillofac. Surg.* 1999; **28**: 243-252.
3. Dobson JE, Newell MJ, Shepherd JP. Trends in maxillofacial injuries in war-time (1914-1986). *Br J Oral Maxillofac Surg* 1989; **27**: 441-450.
4. Maloney PL, Lincoln RE, Coyne CP. A protocol for the management of compound mandibular fractures based on the time from injury to treatment. *J Oral Maxillofac Surg* 2001; **59**: 879-884.
5. Champy M, Lodde JP. Mandibular synthesis. Placement of the synthesis as a function of mandibular stress. *Rev Stomatol Chir Maxillofac* 1976; **77**: 971-976.
6. Kuriakose MA, Fardy M, Sirikumara M, Patton DW, Sugar AW. A comparative review of 266 mandibular fractures with internal fixation using rigid (AO/ASIF) plates or miniplates. *Br J Oral Maxillofac Surg* 1996; **34**: 315-321.
7. Kroon FH, Mathisson M, Cordey JR, Rahn BA. The use of miniplates in mandibular fractures. An in vitro study. *J Craniomaxillofac Surg* 1991; **19**: 199-204.
8. Olsen RA, Fonseca RJ, Zeitler DL, Obson DB. Fracture of the mandible: a review of 580 cases. *J Oral Maxillofac Surg* 1982; **40**: 23-28.
9. Tevepaugh DB, Dodson TB. Are mandibular third molars a risk factor for angle fractures? A retrospective cohort study. *J Oral Maxillofac Surg* 1995; **53**: 646-649.
10. Lee JT, Dodson TB. The effect of mandibular third molar presence and position on the risk of an angle fracture. *J Oral Maxillofac Surg* 2000; **58**: 394-398.
11. Ellis E III, Walker L. Treatment of mandibular angle fractures using two noncompression miniplates. *J Oral Maxillofac Surg* 1994; **52**: 1032-1036.
12. Rubin MM, Koll TJ, Sadoff RS. Morbidity associated with incompletely erupted third molars in the line of mandibular fractures. *J Oral Maxillofac Surg* 1990; **48**: 1045-1047.
13. Gerbino G, Tarello F, Fasolis M, De Giovanni PP. Rigid fixation with teeth in the line of mandibular fractures. *Int J Oral Maxillofac Surg* 1997; **26**: 182-186.
14. Mellor SG. Antibiotics and trauma. *Trauma* 1999; **1**: 157-161.
15. Anderson T, Alpert B. Experience with rigid fixation of mandibular fractures and immediate function. *J Oral Maxillofac Surg* 199; **50**: 555-560.
16. Schierle HP, Schmelzeisen R, Rahn B, Pytlik C. One- or two-plate fixation of mandibular angle fractures? *J Craniomaxillofac Surg* 1997; **25**: 162-168.
17. Levy FE, Smith RW, Odland RM, Marentette LJ. Monocortical miniplate fixation of mandibular angle fractures. *Arch Otolaryngol Head Neck Surg* 1991; **117**: 149-154.
18. Fordyce AM, Lalani Z, Songra AK, Hildreth AJ, Carton ATM, Hawkesford JE. Intermaxillary fixation is not usually necessary to reduce mandibular fractures. *Br J Oral Maxillofac Surg* 1999; **37**: 52-57.