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Incidence, aetiology, treatment outcome and complications of maxillofacial fractures. A retrospective study from Northern Greece

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ABSTRACT

Aim: To analyse the pattern of maxillofacial injuries and treatment outcomes in Northern Greece.
Methods: A tertiary referral single centre hospital; retrospective chart review. Demographics, aetiology, fixation technique (Rigid Internal Fixation: RIF; Maxillomandibular Fixation: MMF) post-surgical infections, aesthetics and occlusion were recorded.
Results: One thousand and ten males and 229 females were operated between 1998 and 2008. Mean age was 29.6 ± 13. Mean number of plates per patient was 3.96 ± 2.28. For those with midfacial fractures ($n = 379$) mean was 4.02 ± 2.05. For those with mandibular fractures ($n = 333$), mean was 2.74 ± 0.94 while those with combined mandible and midface fractures ($n = 216$) were treated using 5.74 ± 2.87 plates per patient. Among those treated with plates, an unadjusted 22% increased risk for post-surgical infection per plate used (OR = 1.22, 95%CI: 1.13–1.32) was found. Patients with mandibular fractures were more satisfied with their post-surgical facial appearance in contrast to those with midfacial or combined midfacial and mandibular fractures. Female patients were less satisfied with their post-surgical facial appearance than males.
Discussion: This study verified a young males predominance, a shift towards more assault related fractures –especially in females– and similar post-surgical results for MMF and RIF modalities in mandibular fractures. In those patients treated with RIF, placement of fewest plates possible to obtain stability better serves aesthetics at the same time reducing risk for post-surgical infections and malocclusion.

1. Introduction

Trauma is the leading cause of death in the first 40 years of life (Bither et al., 2008). WHO Statistics indicate that 1million people die and between 15 and 20 million are injured annually in road traffic accidents (Bither et al., 2008). Many epidemiological studies have been published from different countries about the pattern of maxillofacial injuries but demographic data are difficult to evaluate because of the many variables. Most statistical analyses about maxillofacial injuries have been retrospective (Bakardjiev and Pechalova, 2007). The information is as diverse as the countries and their people, and among the causes road crashes were the most common in developing countries (Bormann et al., 2009). Their incidence and aetiology are influenced by social, cultural, and environmental factors (Subhashraj et al., 2007). The purpose of the study was to analyse the pattern of maxillofacial injuries in Northern Greece, and examine various factors that may have an effect on their distribution.

2. Materials and methods

This was a retrospective chart review of patients treated for facial fractures in a solitary maxillofacial surgery clinic in Northern Greece, covering a population of approx. 2.5 million inhabitants. To minimize selection bias all patients treated in the clinic between 1998 and 2008 were included. Variables recorded included sex, age, childhood (age < 18 years), year of presentation, fracture(s) site(s), fracture aetiology (sports, assault, two-wheel vehicles, four-wheel vehicles, labour, fall), presence of concurrent dental injury, treatment modality [maxillomandibular fixation (MMF) or rigid internal fixation (RIF)], follow-up, complications and post-operative

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assessment (including occlusion and aesthetics). Surgical treatment was in most cases performed by specialist registrars under guidance of two oral maxillofacial surgeon consultants. When the registrars were deemed unable to manage requested tasks, or in complicated procedures, the consultants themselves undertook the main stages of the procedure to maintain uniform standards according to clinic protocol. For mandibular fractures, maxillomandibular fixation (MMF) or rigid internal fixation (RIF) was used. RIF was in all cases monocortical. MMF was usually accomplished using arch bars while intermaxillary screws were used in few cases. MMF duration was typically 6 weeks. On the other hand, when RIF was planned, intermaxillary screws were used intraoperatively to stabilize the occlusion. Those screws were retained with elastics for 2 weeks postoperatively in appropriate cases. Condylar fractures were treated either closed with MMF (rigid or elastic) or open with RIF. All other mandibular sites (angle, ramus, body, mental symphysis) were also treated using a closed approach with MMF or an open approach with RIF. For midfacial fractures, either RIF or simple reduction (for those deemed sufficiently stable without fixation) was used. Again, closed reduction was done using either Keen or Gillies approach while open reduction was in all cases accompanied by RIF.

Post-surgical complications ranging from mild inflammation to abscesses and osteomyelitis were clinically evaluated in the immediate post-operative period and on follow-up. According to clinic protocol, follow-up examinations were performed 6 months after the trauma and included assessment of the following clinical parameters: (i) patient self-assessment of aesthetic appearance with a visual analogue scale (VAS) with values from 0 (worst score) to 10 (excellent appearance). Patients were prompted to compare the fracture side with the healthy contralateral or with their previous appearance. (ii) Assessment of occlusion (identical to the pretraumatic, slightly different or functional minor malocclusion or malocclusion which required further treatment). These observations were recorded by oral and maxillofacial surgery residents who were not involved in the treatment planning and subsequent operative procedures of the patients.

Scale variables were examined for normality. If normality assumptions were not met, non-parametric tests were used. Non-parametric Pearson's Chi-Square and Mann–Whitney *U*-test were used. For between group comparisons, one-way ANOVA with Bonferroni correction was used. Linear regression was utilized to quantify the effect of a scale or ordinal variable on another. Logistic regression was used for dichotomous variables. Given the sample size, this study could detect an effect size of 10% among three patient groups, using one-way ANOVA with a power $1-\beta = 89\%$. For Pearson's Chi-Square statistic, the same effect size could be detected for three degrees of freedom with a power of $1-\beta = 85\%$. Alpha is set to 0.05. All statistical calculations were made with the SPSS 18.0 (Statistical Package for Social Sciences, SPSS Inc., Chicago, IL, USA).

3. Results

One thousand two hundred thirty-nine patients were included in the study, 1010 males and 229 females who were operated between 1998 and 2008. Mean age of patients was 29.6 ± 13.6 (range 2–95) for males while it was 32.9 ± 17.1 (range 6–87) for females. There were 113 (9.1%) children and 1126 (90.9%) adults. Four hundred and forty-five (35.9%) patients were treated for midface fractures alone, 571 (46.1%) for mandibular fractures alone while 223 patients (18.0%) had both mandibular and midfacial fractures. In 485 (42.1%) patients the main affliction concerned the left side, in 474 (41.1%) the right side, while 194 (16.8%) patients had bilateral fractures or principal midline fractures.

Of those patients ($n = 795$) with any mandibular fractures, 208 had fractures of the symphysis or the parasymphyseal area. Eight of them had bilateral fractures. Three hundred and seventy-six patients had corpus fractures (6 of whom bilateral), 301 patients had angle fractures (4 of them bilateral), 411 patients had subcondylar fractures (21 of whom bilateral) while 49 patients had TMJ fractures (4 of whom bilateral).

Four hundred and fifteen patients had zygomatic complex fractures of whom 14 bilateral. Two hundred and sixteen patients had orbital floor fractures of whom 5 bilateral, 147 patients had zygomatic arch fractures of whom 1 bilateral. Sixty patients had NOE fractures, of whom 1 bilateral.

One hundred and eighty-nine patients had fractures along Le Fort lines. There were 35, 69 and 52 typical Le Fort type I, II and III fractures, respectively. Another 27 patients had fractures in combined lines of Le Fort II and Le Fort III while 6 patients had fractures in combined lines of Le Fort I and Le Fort III. Eighty-six patients had nasal bone fractures. The frontal bone was fractured in 36 patients. Fig. 1 presents fracture sites. Mandibular fractures in the paediatric

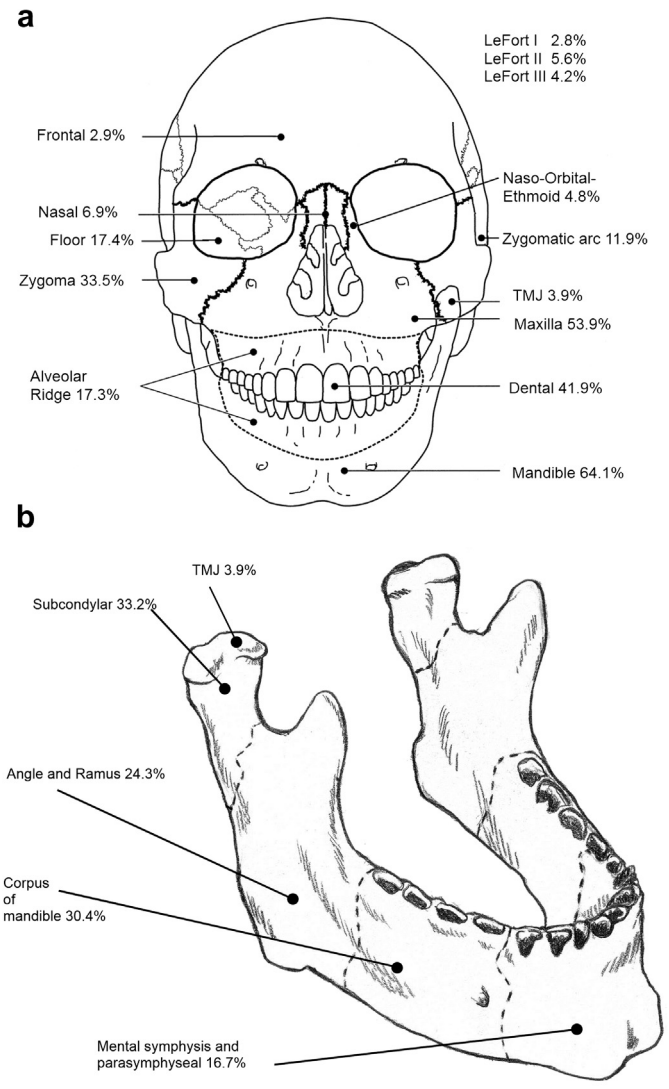

Fig. 1. Fracture sites from 1239 patients with maxillofacial trauma. (a) Lower, middle, upper facial skeleton fractures: zygoma, 415; orbital floor, 216; arch, 147; naso-orbital-ethmoid, 60; nasal, 86; frontal, 36; Le fort I, 35; Le fort II, 69; Le fort III, 52. (b) Mandibular fractures: mental, 208; corpus, 376; angle, 301; subcondylar, 411; TMJ, 49.