Variables Related to Surgical and Nonsurgical Treatment of Zygomatic Complex Fracture

Sergio Olate, DDS, MS, PhD,* † Sergio Monteiro Lima Junior, DDS, MS,* Renato Sawazaki, DDS, MS, PhD,* Roger William Fernandez Moreira, DDS, JD, MS, PhD, and Maácio de Moraes, DDS, MS, PhD*

Abstract: The aim of this retrospective research was to establish the association between variables for the surgical treatment of zygomatic complex (ZC) fractures. In a 10-year period, 532 patients were examined for ZC fractures. The medical records of patients were analyzed to obtain information related to sociodemographic characteristics, trauma etiology, sign and symptoms of patients, and surgical or nonsurgical treatment. Statistical analysis was performed using \( \chi^2 \) test with statistical significance of \( P < 0.05 \). Most fractures were sustained by subjects between 21 and 40 years of age (55.8%), being principally men (80.1%), and 153 patients underwent surgery (28.8%). Surgical treatment of ZC fractures was statistically associated to the presence of other facial fractures (\( P = 0.004 \)), alteration of occlusion (\( P = 0.0001 \); probably due to jaw fractures), presence of the comminuted fractures (\( P = 0.0002 \)), and infraorbital nerve sensory disturbances (\( P = 0.003 \)). A mixture of complex variables can be associated to surgical treatment; however, variables as comminuted fracture and alteration of occlusion were associated to surgical treatment indications.

Key Words: Zygomatic complex treatment, surgical treatment, nonsurgical treatment


Fractures of the zygomatic complex (ZC) and their treatment are frequently mentioned in the maxillofacial literature, and many articles pertaining to the incidence, causes, and treatment have been published. However, the combination of scientific advances and traditional surgical practice has created a diversity of approaches and challenging diagnostic and reconstructive problems for the surgeon.

The particular position that the zygoma occupies in the facial areas makes it one of the locations most frequently subject to trauma and fractures, both isolated or in association with other facial fractures. The prevalence of ZC trauma is at 30% to 45% of all midface fractures. The management of these fractures is controversial, evidenced by a variety and often conflicting treatment philosophies described in the literature.

Complications of ZC fracture and repair include limited range of motion, lack of zygoma projection, diplopia, enophthalmos, globe displacement, and retrobulbar hemorrhage. A good aesthetic appearance is as important as the functional recovery; therefore, the approach to the fractures involving the malar area must be carried out while analyzing the cause by the sign and symptoms. It has been generally accepted that nondisplaced or asymptomatic fractures are related to nonsurgical treatment. But there are still unsolved questions with regard to the treatment of ZC fractures: which are the variables related to surgical or nonsurgical treatment?

This article discusses the indications to surgical or nonsurgical treatment and evaluates the patient characteristics related to treatment modality.

SUBJECTS AND METHODS

Data were collected from patients who attended at the Division of Oral and Maxillofacial Surgery of the State University of Campinas, Brazil, from April 1, 1999, to December 31, 2008. Information was obtained retrospectively from clinical notes and surgical records from each patient using a standardized and specific data collection form. The records were reviewed for the following data: patient sex, age, etiology, diagnosis, type of zygoma fracture, dislocation of the fractures, associated facial and general trauma, methods of treatment, complications, and status of the dentition. Exclusion criteria were medical records that did not have complete information on the trauma or treatment. This research was approved by the Comité de Ética em Pesquisa da Universidade Estadual de Campinas with protocol number of 131/2008.

It has evaluated the possible influence of time among trauma, first evaluation, and surgical indications. The etiology of the ZC fractures was classified as car, motorcycle, bicycle, pedestrian–motor vehicle accidents, work-related and sports-related accidents, falls, individual violence, and others that did not fit any of the categories mentioned. The ZC fractures were diagnosed as unilateral or bilateral, and ZAs were diagnosed as isolated, associated to ZC fracture or other maxillofacial fractures. The classifications of fractures were based on a conventional radiographic study and computed tomographic examinations, and the segment displacement was evaluated with clinical and image techniques. They were classified in nondisplaced and displaced. Sign and symptoms of patient were evaluated as pain, neurologic disturbance of infraorbital nerve, asymmetry related to osseous fragment displacement, occlusion alteration, and diplopia.

Other facial fractures were classified as mandible fractures, condylar fractures, maxillary fractures, isolated nasal bone fractures, frontal fractures, naso-orbital-ethmoid complex fractures and alveolar fractures. General trauma was classified according to the anatomic location of the injury (cranium, neck, thorax, abdomen, upper limb, lower limb, and extremities) and the general conditions of the patient. The trauma was classified from 1 to 6, according to the severity of the general conditions of the patient.

The authors report no conflicts of interest. Copyright © 2011 by Mutaz B. Habal, MD
ISSN: 1049-2275
DOI: 10.1097/SCS.0b013e31821e0ce4
and lower limb). Occupation activities were divided in economic active patients, students, and retired patients.

Data analysis involved a descriptive analysis, which was made for each variable. The $\chi^2$ test was used to compare the counts of categorical response between 2 independent variables. The association between the variables had been considered significant when $P < 0.05$.

**RESULTS**

Five hundred thirty-two patients were evaluated for ZC fracture in a 10-year period, with 426 men (80.1%) and 106 women (19.9%); the average age was 35.3 years (ranging from 1 to 97 years) with most patients between 21 and 40 years (55.8%). One hundred fifty-three patients (28.8%) were submitted to surgical treatment, and 71.2% did not need surgical assistance (Table 1). Most of the patients (19.5%) have injuries because of a personal aggression; falls were the second major cause (18.4%). Other injuries were a result of bicycle accidents (14.5%), motorcycle accident (13.7%), and car accidents (12.4%; Table 2).

Patients were usually evaluated at the same day of trauma (34.6%). In admission, 69.3% of surgical patients were primarily evaluated between 0 and 3 days after injury; on average, patient evaluation was 3.5 days after trauma, without statistical relation with surgical treatment ($P = 0.974$). The most common facial fracture associated to ZC fracture was mandible fracture followed by maxillary and nasal fractures. Zygomatic complex fractures associated to 1 or more facial fractures were positively associated to surgical treatment ($P = 0.004$; Table 3).

Fifty-two surgical cases (33.9%) presented fracture displacement, and almost 50% of surgical cases presented comminuted fractures, especially at the zygomaticomaxillary pillars. Considering the symptoms, most cases showed edema, ecchymosis, asymmetry, and trismus, being close to 65.9% of 532 patients and 71.9% of surgical patient, without statistical significance with surgical treatment ($P = 0.145$). Alteration of occlusion was positively associated to surgical treatment ($P = 0.0001$). On the other hand, sensory disturbances of the (ION) were found in 53.6% of surgical patients and 42.7% of total admissions, being statistically significant associated with surgical treatment ($P = 0.003$). Diplopia was present in 8.08% of total admission and did not show relation with surgical treatment indications ($P = 0.707$).

**DISCUSSION**

The evaluation of treatment modalities used in trauma patients is difficult because of the unique nature of each individual injury. One of the primary reasons for nonsurgical management in facial fractures is undisplaced or minimally displaced fracture, minimal symptoms, refused treatment, and asymptomatic conditions. In ZC fractures, the symptoms are common, with facial asymmetry, trismus, diplopia, emphysema, ecchymosis, and other warranting surgical management.

Recognizing which variables are associated to surgical management of ZC fracture should help surgeons to describe objective criteria for surgical indications.

The best treatment time is generally considered to be as early as possible for fractures of the midface. In ZC fractures, the symptoms are common, with facial asymmetry, trismus, diplopia, emphysema, ecchymosis, and other warranting surgical management.

The etiologic factor associated to facial trauma changes according to the time of study, demographics, culture, and social characteristics of the population; our result shows high incidence of low and middle energy trauma (aggression, fall, sport-related, and bicycle accident), representing 60.1% of sample.

**TABLE 1.** Distribution of ZC Fractures by Age and Surgical and Nonsurgical Treatment

<table>
<thead>
<tr>
<th>Age (y)</th>
<th>Surgical Management</th>
<th>Nonsurgical Management</th>
<th>Total ZC Fracture</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>1–10</td>
<td>1</td>
<td>0.1</td>
<td>13</td>
</tr>
<tr>
<td>11–20</td>
<td>21</td>
<td>4.5</td>
<td>98</td>
</tr>
<tr>
<td>21–30</td>
<td>60</td>
<td>39.3</td>
<td>97</td>
</tr>
<tr>
<td>31–40</td>
<td>42</td>
<td>27.6</td>
<td>57</td>
</tr>
<tr>
<td>41–50</td>
<td>16</td>
<td>10.6</td>
<td>32</td>
</tr>
<tr>
<td>51–60</td>
<td>7</td>
<td>4.5</td>
<td>22</td>
</tr>
<tr>
<td>61–70</td>
<td>5</td>
<td>3.4</td>
<td>20</td>
</tr>
<tr>
<td>≥71</td>
<td>0</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>153</td>
<td>100</td>
<td>379</td>
</tr>
</tbody>
</table>

**TABLE 2.** Distribution of ZC Fractures by Sex and Etiology

<table>
<thead>
<tr>
<th>Sex</th>
<th>Car</th>
<th>Motorcycle</th>
<th>Bicycle</th>
<th>Pedestrian–Motor Vehicle Accidents</th>
<th>Work</th>
<th>Sport</th>
<th>Aggression</th>
<th>Fall</th>
<th>Others</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>20</td>
<td>7</td>
<td>12</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>18</td>
<td>35</td>
<td>3</td>
<td>106</td>
</tr>
<tr>
<td>Male</td>
<td>46</td>
<td>66</td>
<td>65</td>
<td>30</td>
<td>19</td>
<td>40</td>
<td>86</td>
<td>63</td>
<td>11</td>
<td>426</td>
</tr>
<tr>
<td>Total</td>
<td>66</td>
<td>73</td>
<td>77</td>
<td>34</td>
<td>22</td>
<td>44</td>
<td>104</td>
<td>98</td>
<td>14</td>
<td>532</td>
</tr>
</tbody>
</table>
In our research group of 532 cases, only 28.8% needs surgical treatment. For Chuong and Kaban, open reduction is indicated following clinical and radiographic criteria: (a) significant facial asymmetry, (b) enophthalmos, (c) altered canthal position, or (d) mechanical restriction of mandible excursion, where most cases were restricted to hospitalized patients. These concepts are prevalent in high energy trauma, with displaced fracture and orbital complex involvement. High energy trauma is associated to more complex facial trauma, with naso-orbital-ethmoid, maxillae, or mandible fractures; it is interesting to note that 40% of surgical patients present other facial fractures without statistically relation to surgical treatment \( (P = 0.5631) \). However, when occlusion was involved, as mandible fractures, surgical treatment options present a major statistical relation \( (P = 0.0001) \). Based on these results, ZC fracture with occlusion component is an indication for surgical treatment.

Comminuted and displaced fractures are associated with high and middle energy trauma and usually needs surgical treatment. In this group, displaced fractures (33.9%) did not present relation with surgical treatment \( (P = 0.112) \), and comminuted fractures (49.7%) presented significant association with surgical treatment \( (P = 0.0002) \). Displaced fractures require an open reduction and surgical approach for adequate visualization and proper reduction, but in this research, displacement was not indicative of surgical treatment. On the other hand, displacement was associated with sensory disturbances of ION, which in turn was related to surgical treatment \( (P = 0.003) \). The research of Jungell and Lindqvist shows that only 18% of ZC fractures do not present sensory disturbances and 73.5% of surgical patient show that sign. For Kovács and Ghahremani, only 5.8% did not present sensory disturbances, showing high association with surgical treatment.

Diplopia usually indicates orbital compromise, and these cases require more extensive evaluation and observation; in our research, only 8% presented this sign, comparable with other researches that show 7% of diplopia in surgical patients. Of 43 cases with diplopia, only 8 were surgical patients. Based on our finding, diplopia is not statically associated with surgical treatment of ZC fractures \( (P = 0.707) \).

Finally, we conclude that etiology and severity of the injury as well as the existence of other injuries are important factors for primary orientation. The complex evaluation of a patient with maxillofacial fractures allows that different factors involved in this evaluation present a final treatment; however, certain specific variables can be associated to surgical treatment as the presence of other facial fractures, alteration of occlusion, presence of comminuted fractures, and ION sensory disturbances.

**REFERENCES**