Refining Operative Indications for Zygomaticomaxillary Complex Fracture Repair

Rachna Goli BS, Vinay Rao MD, Joseph W Crozier MA, Albert S Woo MD
Warren Alpert Medical School of Brown University and Rhode Island Hospital

Introduction

- The zygomaticomaxillary complex (ZMC) is the main skeletal buttress of the midface.
- Although ZMC fractures are among the most common facial injuries, the optimal approach to repair remains controversial.
- Clinical symptomatology of ZMC fractures commonly includes: malar flattening, facial asymmetry, appreciable displacement, palpable step-off, malocclusion (misaligned teeth), trismus (limited range of motion in the jaw), weakness, paresthesias, diplopia, and enophthalmos.
- The primary aim of this study is to understand the relationships between specific impaction measures derived from pre-operative CT imaging and clinical symptomatology to create a model that predicts need for surgical intervention.

Methods

- Retrospective analysis on patients with ZMC fractures seen at a Level I Trauma Center between 2015 and 2020.
- Exclusion criteria: patients with additional midfacial fractures beyond the zygoma.
- Variables recorded from the medical record: patient demographics, CT characteristics (degree of anatomic displacement), and symptoms indicating surgical intervention.
- Logistic regression analyses elucidated relationships between impaction measurements on CT imaging and symptomatology necessitating surgery.

Impaction Measurements

- Retrospective analysis on patients with ZMC fractures seen at a Level I Trauma Center between 2015 and 2020.
- Exclusion criteria: patients with additional midfacial fractures beyond the zygoma.
- Variables recorded from the medical record: patient demographics, CT characteristics (degree of anatomic displacement), and symptoms indicating surgical intervention.
- Logistic regression analyses elucidated relationships between impaction measurements on CT imaging and symptomatology necessitating surgery.

Results

- 95 patients with ZMC fractures were included. 31% (n=29) presented with facial asymmetry or malar flattening, 17% (n=16) with trismus, 28% (n=27) with appreciable displacement or step-off, and 11% (n=10) with malocclusion.
- Presentation of malar flattening was significantly predicted by maxillary wall impaction and anterior-posterior fracture displacement.
- Maxillary wall impaction on CT also significantly predicted appearance of appreciable displacement.
- Vertical displacement most strongly predicted malocclusion.

Conclusions

- Our final regression model demonstrates that certain CT characteristics of ZMC fractures reliably predict symptoms requiring surgery. These CT measures include: maxillary wall impaction, anterior-posterior displacement, and vertical displacement.
- These findings may be applied to informing patients with ZMC fractures of their risk for developing specific symptoms based on CT imaging of their injuries.
- Ultimately, understanding specific relationships between symptomatology and CT impaction measures may guide the development of a standard, objective protocol for surgical management of ZMC fractures.

Table 1. Relationship between common symptomatology and CT characteristics of zygomaticomaxillary complex fractures

<table>
<thead>
<tr>
<th>Symptom</th>
<th>CT Characteristic</th>
<th>Estimate</th>
<th>OR</th>
<th>CI</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malar flattening</td>
<td>Maxillary wall impaction</td>
<td>3.09</td>
<td>21.9</td>
<td>4.7, 132.6</td>
<td>0.0002</td>
</tr>
<tr>
<td>or asymmetry</td>
<td>AnTERior-posterior</td>
<td>1.70</td>
<td>5.5</td>
<td>1.5, 22.2</td>
<td>0.0122</td>
</tr>
<tr>
<td></td>
<td>displacement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lateral-medial displacement</td>
<td>-0.66</td>
<td>0.5</td>
<td>0.1, 2.6</td>
<td>0.4258</td>
</tr>
<tr>
<td>Obvious displacement</td>
<td>Maxillary wall impaction</td>
<td>2.07</td>
<td>7.9</td>
<td>2.0, 36.7</td>
<td>0.0049</td>
</tr>
<tr>
<td>Malocclusion</td>
<td>Vertical displacement</td>
<td>3.88</td>
<td>48.2</td>
<td>1.8, 2022.0</td>
<td>0.029</td>
</tr>
<tr>
<td>Trismus</td>
<td>Vertical displacement</td>
<td>0.76</td>
<td>2.1</td>
<td>0.2, 31.3</td>
<td>0.568</td>
</tr>
</tbody>
</table>

Acknowledgments

Funding was provided by Alpert Medical School.