Role of CT scan in facial pillar fractures- What Radiologist needs to see and surgeon needs to know?

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Objective:
Describe the buttresses of the mid facial skeleton and accurate description of facial fractures
Information about the involvement of specific facial buttresses and its complications.
Identify surgically relevant and emergent patterns of mid-face fractures.

I. Introduction:
Face has five paired bones and four unpaired bones.
Four pairs each of horizontally and vertically oriented struts.

FACIAL PILLARS -Anterior view²:
Facial fractures classification:
1. Sinus wall fractures (Frontal and sphenoid).
2. Central mid face- Le fort, Wassmund, Naso-orbitoethmoid.
3. Lateral mid face, Tripod, Zygomatic arch, Zy-max, Zy-mand, Orbital floor

<table>
<thead>
<tr>
<th>Facial Buttresses</th>
<th>Fracture line Involves...</th>
<th>Complications of such fractures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper transverse maxillary</td>
<td>Orbital floor</td>
<td>SOF and Orbital apex syndrome</td>
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<tr>
<td></td>
<td>Zygoma</td>
<td>Globe ruptures (FLAT TIRE SIGN) Inferior</td>
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<td></td>
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<td>rectus muscle entrapment.</td>
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<td>Lower transverse maxillary</td>
<td>Hard palate</td>
<td>Dental fracture, avulsion and malocclusion.</td>
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<td></td>
<td>Alveolus</td>
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<td>Upper transverse mandibular</td>
<td>Ramus</td>
<td>Inferior alveolar nerve injury</td>
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<tr>
<td></td>
<td>Alveolar margin</td>
<td>Secondary infection</td>
</tr>
<tr>
<td>Lower transverse mandibular</td>
<td>Inferior margin</td>
<td>Inferior alveolar nerve injury</td>
</tr>
<tr>
<td>Medial maxillary</td>
<td>Medial walls of orbit and maxillary</td>
<td>Sinus obstruction, CSF rhinorrhea, Medial</td>
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<tr>
<td></td>
<td>sinus</td>
<td>canthal tendon injury, Epistaxis and</td>
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<td></td>
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<td>Lacrimal sac injury.</td>
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<tr>
<td>Lateral maxillary</td>
<td>Lateral walls of orbit and sinuses</td>
<td>SOF and Orbital apex syndrome</td>
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<td></td>
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<td>Lateral canthal ligament injury</td>
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<tr>
<td>Posterior maxillary</td>
<td>Sphenoid bone</td>
<td>Carotid artery injury. CCF, Skull base</td>
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<td>foraminal injury, malocclusion and trismus.</td>
</tr>
<tr>
<td>Posterior mandibular</td>
<td>Angle, ramus and condyle of mandible</td>
<td>Skull base foraminal injury, malocclusion and</td>
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<td></td>
<td></td>
<td>trismus.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Central midface fractures</th>
<th>Lefort I Floating palate</th>
<th>Lefort II Floating maxilla</th>
<th>Lefort III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical features</td>
<td>Gingival crepitation</td>
<td>Orbital ecchymosis</td>
<td>Orbital ecchymosis</td>
</tr>
<tr>
<td></td>
<td>No orbital ecchymosis</td>
<td>Infraorbital parasthesia</td>
<td>CSF rhinorrhea</td>
</tr>
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DOI: 10.9790/0853-1705056370 www.iosrjournals.org 64 | Page
Role of CT scan in facial pillar fractures - What Radiologist needs to see and surgeon needs to know?

<table>
<thead>
<tr>
<th>Involved facial buttress</th>
<th>Movement at lower maxilla, not at nasal root</th>
<th>Movement at nasal root, with infraorbital step</th>
<th>Movement at nasal root with lateral orbital rim movement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower transverse maxillary buttress and posterior maxillary buttresses.</td>
<td>Superior medial, inferior lateral, upper transverse and posterior maxillary buttresses</td>
<td>Superior portions of the medial, lateral, upper transverse and posterior maxillary buttresses</td>
<td></td>
</tr>
</tbody>
</table>

Fracture lines run through:
- Nasal septum
- All walls of maxillary sinus
- Pterygoid plates of sphenoid

Nasal bone fractures:

Drawings show the common Le Fort fracture pattern 4.

![Le Fort fracture pattern diagrams](image)

Nasal bone fractures:

- Nasal bone and septum, Medial orbital wall, Floor of orbit, Walls of maxillary sinus, Pterygoid plates of sphenoid, Medial and lateral wall of orbit, Zygomatic arch, Pterygoid plates of sphenoid
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Right nasal bone fracture.

Depressed fracture of nasal bone.

Displaced fracture of right nasal bone.

Naso-Orbito-Ethmoid (NOE) complex fracture

Bilateral medial maxillary buttresses involvement.

Markowitz and Manson classification:

I - Intact medial canthal tendon, connected to a single large fracture fragment

II - Comminuted # with medial canthal tendon attachment to a single bone fragment

III - Comminution extension to the medial canthal tendon insertion site (anterior medial orbital wall at lacrimal fossa level) with resultant avulsion of the tendon.
Degree of comminution of medial orbital wall at lacrimal fossa level may be helpful for surgical planning of medial canthal tendon repair.
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Tetrapod or Quadripod fracture (Tripod / Malar fracture):
Disruption of both the lateral maxillary and upper transverse maxillary buttresses

**Sutures involved:**
- Zy-frt
- Zy-sph
- Zy-Tmp
- Zee-Max

Hendrickson types of Palatal fracture:

1. Anterior and posterolateral alveolar.
2. Sagittal.
3. Parasagittal.
4. Para alveolar.
5. Complex.
6. Transverse.

DOI: 10.9790/0853-1705056370  www.iosrjournals.org  68 | Page
Sinus Wall Fractures (Frontal and sphenoid):

![Anterior table](image1)
![Combined table](image2)

<table>
<thead>
<tr>
<th>COMPLICATIONS</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nasofrontal duct obstruction</td>
<td>Sinus obliteration</td>
</tr>
<tr>
<td>CSF leak</td>
<td>Canalization of sinus</td>
</tr>
</tbody>
</table>

Complications of facial fractures:

- Left Optic strut fracture:
- Bilateral nasolacrimal duct injury

II. Conclusion:

- Accurate classification of facial fractures and identification of related complications by the radiologist permit prompt surgical management and improved clinical outcome of these common traumatic injuries.
- Surgical management of fractures and their associated complications is according to the specific facial buttress involved.
- Severe haemorrhage from massive facial injuries may result in death. Airway obstruction, if not properly treated or detected, is associated with high mortality.

III. Summary:

Facial buttress is a supporting structure of the face. Anatomy of the facial buttress is very important for classification of facial fractures and associated complications.

Trauma to the maxillofacial region needs special attention as it contains important special sensory systems contained within the face. (e.g. vision, auditory, somatic sensation, gustatory, olfaction, and vestibular). Also, vital structures in the head and neck region are intimately associated (airway, blood vessels, nerves, and gastrointestinal tracts). Lastly, the psychological impact of disfigurement can be devastating.
CT scan is the gold standard imaging technique to diagnose maxillofacial fractures. The sensitivity of a routine non enhanced head CT scan for fracture surveillance was found to be 100% [6].

References: