Maxillofacial injuries can be complex and multi-specialty involvement in their management may be needed. Injury can involve the skin and soft tissues as well as resulting in fractures. Acute and long-term psychological problems can result from maxillofacial trauma and disfigurement.\cite{1, 2} The first human face allograft was successfully performed in 2006 in France and has potential for use in facial reconstructive surgery secondary to maxillofacial trauma.\cite{3}

**Anatomy**\cite{4}

The maxillofacial region can be divided into three parts:

- **The upper face** - the frontal bone and frontal sinus.
- **The midface** - the nasal, ethmoid, zygomatic and maxillary bones.
- **The lower face** - the mandible.

The region of the orbit:

- **The superior orbital margin** is formed by the frontal bone.
- **The lateral orbital margin** is formed by the frontal process of the zygoma, the zygomatic process of the frontal bone and the greater wing of the sphenoid bone.
- **The inferior orbital margin** is formed by the maxilla and the zygoma.
- **The medial orbital margin** is formed by the frontal process of the maxilla, the lacrimal bone, the angular and orbital process of the frontal bone and the ethmoid bone.
- **The orbital floor** is formed by the roof of the maxillary sinus.
- **Parts of the sphenoid, palatine and ethmoid bones** form the apex of the orbit.

Blood and sensory supply:

- Branches of the external carotid artery supply blood to the face.
- The facial nerve supplies the muscles of facial expression.
- The ophthalmic, maxillary and mandibular branches of the trigeminal nerve supply sensation to the skin of the face.

Separate articles entitled *Examination of the Cranial Nerves* and *Cranial Nerve Lesions* discuss the cranial nerves in more detail.

**Aetiology**\cite{5}

Maxillofacial trauma is usually caused by:

- Assault (most common; domestic violence is an important cause; alcohol may be involved).\cite{6}
- Road traffic accidents (midface fractures can occur).
- Falls.
- Sporting accidents.


**General assessment of maxillofacial injuries**

- First look for associated life-threatening injuries. There may be associated cervical spine and significant head injury.
- Assess 'Airway, Breathing and Circulation' (ABC) and manage appropriately.

**History**

Once stable, relevant history may include:\cite{7}

- Mechanism of injury.
- Whether there was any loss of consciousness.
- Any visual disturbance, including disturbance of eye movement.
- Any problems with hearing, including vertigo and tinnitus.
- Any discharge from the ears or nose, including blood or cerebrospinal fluid (CSF).
- Any problems with breathing through the nose.
- Ability to bite down without pain and feeling of whether the teeth come together normally.
- Any numbness or tingling on the face.
Examination

- Look for facial asymmetry. Stand at the head of the bed and look down from above to check the level of the cheekbones. The nasal bridge width is usually half the interpupillary distance.
- Inspect for bruising, swelling, lacerations, missing tissue, foreign bodies and bleeding.
- Palpate for bony injury and crepitus systematically.
- Inspect the eyes. Examine eye movements. Assess pupils.
- Check for foreign bodies and lacerations by everting the eyelids.
- More detailed examination is required by an ophthalmologist if eye trauma is suspected.
- Inspect the nose, looking for dislocation and telecanthus (widening and flattening of the nasal bridge). Palpate for tenderness and crepitus. Look for septal haematoma, lacerations and CSF rhinorrhoea.
- Ears: look for lacerations and CSF in the canal. Assess the tympanic membrane.
- Inspect the tongue and mouth.
- Palpate the mandible and temporomandibular joint, looking for mobility or crepitus. Also, look for bruising.
- Assessment for Le Fort fractures (see below): put one hand on the anterior maxillary teeth, the other on the nasal bridge. Only the teeth will move in a Le Fort I fracture. If the nasal bridge moves, a Le Fort II or III fracture is present.
- Assess the teeth. Look for avulsed or mobile teeth. Look for jaw malocclusion. If a tooth has been avulsed, note whether it has been aspirated.
- Tongue blade test: ask the patient to bite down hard on a tongue blade. They will be in too much pain to do this if the jaw is fractured.
- Place a finger in the patient’s ear canal to palpate the mandibular condyle. Ask the patient to open and close the mouth. If there is pain or lack of movement, this indicates a condylar fracture.
- Perform a complete cranial nerve examination.

Investigations

- X-ray and CT scanning provide the mainstay of fracture investigation.
- Specific X-ray views are needed depending on the fracture suspected.

Management

- This depends on injury/fracture (see below).
- Pain control will be needed.
- Early photographs may be helpful both to plan treatment and to counsel the patient.

Specific fractures

Frontal bone fractures

- These usually follow a severe blow to the forehead.
- A dural tear should be considered if the posterior wall of the frontal sinus is fractured.
- There may be tenderness, crepitus or disruption of the supraorbital rim. Look for subcutaneous emphysema and reduced sensation of supraorbital and supratrochlear nerves.
- Surgery is needed if the nasofrontal duct is blocked.
- Non-displaced fractures are sometimes managed by observation.
Orbital floor fractures
- These can occur alone or with medial wall fracture.
- There may be herniation of orbital contents into the maxillary sinus.

There are separate articles entitled Zygomatic Arch and Orbital Fractures and Eye Trauma.

Nasal fractures
- There is a separate article entitled Nasal Injury and Nasal Foreign Bodies.

Nasoethmoidal fractures
- These extend from the nose to involve the ethmoid bones.
- They can lead to damage of the lacrimal apparatus, canthus, nasofrontal duct or dural tear at the cribiform plate.
- If a dural tear is suspected, referral to a neurosurgeon is required.
- Ophthalmology, ear, nose and throat, maxillofacial or plastic surgery referral is required to manage other injuries.

Maxillary fractures

Anatomy
The two maxillae form the upper jaw, the anterior part of the hard palate, part of the lateral walls of the nasal cavities, and part of the floors of the orbital cavities. They meet in the midline at the intermaxillary suture and form the lower margin of the nasal aperture.

Classification
- **Le Fort I** - a horizontal fracture across the inferior aspect of the maxilla. May result from a direct blow on the maxillary alveolar rim in a downward direction. The alveolar process and hard palate become separated from the rest of the maxilla. The fracture extends through the lower nasal septum, the lateral maxillary sinus wall and into the palatine bones and pterygoid plates. It can present with facial oedema, loose teeth and a mobile hard palate.
- **Le Fort II** - a pyramidal-shaped fracture. It may result from a blow to the lower or mid-maxilla. The fracture extends from the nasal bridge through the frontal processes of the maxilla, through the lacrimal bones and inferior orbital floor and rim, through or near the inferior orbital foramen, and inferiorly through the anterior wall of the maxillary sinus. It then travels under the zygoma, across the pterygomaxillary fissure, and through the pterygoid plates. It can present with facial oedema, epistaxis, subconjunctival haemorrhage, CSF rhinorrhoea, a mobile maxilla and telecanthus (widening and flattening of the nasal bridge).
- **Le Fort III** - a transverse fracture, also known as craniofacial dysjunction. It may follow a blow to the nasal bridge or upper maxilla. There is separation of all of the facial bones from the cranial base with simultaneous fracture of the zygoma, maxilla, and nasal bones. The fracture line extends through the ethmoid bones, orbits, and pterygomaxillary suture into the sphenopalatine fossa. It presents with massive facial oedema and facial flattening. There may be movement of all of the facial bones in relation to the cranial base.

Management
- Maxillary fractures are usually managed by open reduction and fixation.
- Patients with higher Le Fort injuries have more severe injuries and more frequently need a surgical airway. Those with Le Fort III injuries have a higher chance of needing neurosurgical intervention or experiencing vision-threatening trauma.[9]

Mandibular fractures
- There is a separate article entitled Mandibular Fractures.

Alveolar fractures
- Injuries of the tooth-bearing portion of the mandible are common.
- They can occur after relatively low-impact trauma. The alveolus (tooth-bearing portion of bone) and/or the tooth can be damaged. Segmental fractures that involve multiple teeth can occur.[10]
- They can present with loose or lost teeth and bleeding gums.

Panfacial fractures
- These usually result from high-energy trauma to the face.
- Open reduction with repositioning and internal fixation is needed.

Complications of maxillofacial injuries[11]

Immediate
- Airway compromise.
- Aspiration.
- Haemorrhage.
- Infection.

Longer-term
Scars and permanent facial deformity.
- Chronic sinusitis.
- Nerve damage leading to loss of facial sensation, movement, smell, taste or vision.
- Malocclusion.
- Non-union/malunion of fractures.
- Malnutrition and weight loss.

Prevention of maxillofacial injuries

- Full-face helmets may offer some protection against maxillofacial injury. [12]
- Airbags, non-lacerating windscreens and seatbelts in cars. [13]
- Safety measures in high-risk occupations (eg, farm and forestry workers). [14]
- Gumshields in sports, although it is unclear which offers the best protection for which sport. [15]

Further reading & references


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