I. The Initial Evaluation of the Maxillofacial Trauma Patient

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The most important initial consideration in the patient who has sustained maxillofacial trauma is the evaluation of the patient's airway. The soft tissue swelling, in conjunction with the loss of facial architecture, can cause collapse and obstruction of the oropharyngeal airway. Airway obstruction may result from intraoral hemorrhage, edema, loose teeth, or dislodged dentures. It may also arise from the posteroinferior displacement of the maxilla in Le Fort fractures, and lingual obstruction of the oropharynx as a result of a displaced segmental fracture of the mandible. There is often significant bleeding involved with the acute fracture, making airway management more difficult. In the patient suffering from obvious trauma to the face and presenting with a tenuous airway, oral intubation with in-line traction for C-spine protection is the preferred method of securing the airway. Intracranial passage of the endotracheal tube from an attempted nasotracheal intubation is highly unlikely, even with severe midface trauma. However, not only does this possibility exist, but there is an even greater chance that nasotracheal intubation may result in further disruption of any fractures that may be present in the floor of the anterior cranial fossa. This can lead to new or further dural tears and result in exacerbation or formation of a cerebrospinal fluid (CSF) leak. Moreover, the stasis of nasal/paranasal sinus secretions induced by the presence of a nasal tube may increase the risk of intracranial contamination should communication exist between the intracranial and extracranial compartments as a result of disruption by the fracture. If there is concomitant laryngeal injury or a clearly unstable cervical spine (C-spine), the airway should be secured with tracheotomy or cricothyrotomy. Fiberoptic transnasal intubation can be achieved if the airway is not compromised by intraoral lacerations or severe epistaxis.

Prior to imaging the facial bones, one needs to first consider the possibility of C-spine injury. To this end, a full C-spine series (including the seven cervical and first thoracic vertebrae) needs to be obtained. If no abnormality is detected on these preliminary films, patient-directed flexion and extension views may be considered. In the obtund or otherwise unreliable patient, computed tomographic (CT) scan of the spine and neurologic consultation may be required to fully clear the C-spine. Complete imaging of the facial bones, especially in the coronal plane, is not always possible if the C-spine has not been cleared (inability to extend head, presence of rigid collar). Patients should have rigid collars or sandbags in place until the C-spine has been fully cleared.

As a consequence of the significant amount of force required to cause facial fractures, not infrequently one will note the presence of severe concomitant, often life-threatening, injury in other parts of the body and in the central nervous system. Performing a full general physical, as well as a detailed neurologic examination are important in this patient population. Concomitant cerebral injury is noted in over 50% of patients suffering from a fracture of the midface.[1] In the setting of facial trauma, low Glasgow coma scale scores (less than 5), or radiologic evidence of intracranial hemorrhage are associated with a poor patient outlook in terms of survival.[2] Hence, in this scenario, definitive fracture reduction and fixation should be delayed until the patient is more medically stable.

Orbital content injury is commonly noted in the patient suffering from maxillofacial trauma. Documentation of visual status, globe excursion, and position are mandatory in all of these patients preoperatively. A severe ophthalmologic injury, such as globe disruption, must also be recognized quickly. This is often difficult with the intense periorbital edema that may develop by the time the patient is first seen. In the case of obvious or suspected eye injury, emergent ophthalmologic consultation is mandatory. The lacrimal drainage system also may be disrupted. Generally, acute repair over a Silastic stent needs only to be considered in the obviously transected canalicular system. Epiphora from disruption of the lacrimal drainage system occurs in 4% of Le Fort II and III fractures.[3] Late diagnosis of lacrimal injuries is commonly made many weeks after the initial injury. Schirmer, Jones I, and Jones II tests of lacrimation are invaluable in the determination of the level of lacrimal system obstruction.

Initial evaluation also must include assessment for possible open intracranial injury, especially at the level of the anterior fossa. In severe injuries, herniated brain tissue may be present in a wound, in the sinuses, or within the nasal cavity. Neurosurgical consultation is mandatory in such circumstances.

In the presence of continued nasal or aural discharge, one needs to consider the possibility that a CSF leak may be present. Historical tests for glucose concentration (greater than two thirds of serum levels) and observation of a positive "halo" sign are not as accurate as immunohistochemical determination of the beta2-transferrin content.[4] The beta2-transferrin test is the most specific test available for CSF and is noted even in the presence of blood. One should make note that beta2-transferrin levels also may be elevated in the serum of cirrhotic patients. Thus, in a known cirrhotic patient, the determination of a CSF leak may be ascertained by simultaneous serum and (nasal discharge) fluid assays for beta2-transferrin.

Generally, in fractures of the midface, the site of CSF leaks will often be at the level of the cribriform plate. In fractures of the frontal sinus, leaks are often noted to be arising from dural tears deep to disrupted posterior wall fragments. Anterior cranial fossa floor disruption also is a possible source. If there is any question as to the exact site of origin of a confirmed leak, metrizamide CT cisternography is most helpful in localizing it. Most CSF leaks that arise in the setting of acute facial trauma will seal on their own with conservative treatment (bed-rest with or without a lumbar drain). However, in the presence of a continued leak, consideration to its repair may be given at the time of definitive fracture repair. If a CSF leak is noted at the time of surgical intervention, it should be considered for repair at that time.

Bleeding from facial fractures can result in significant blood loss. Epistaxis or minor bleeding from facial or intraoral lacerations is common. Nasal and/or throat packing may be important in the initial management of such hemorrhage. Exploration for the source of bleeding, however, is uncommonly required.

Rarely, massive, life-threatening hemorrhage may be seen on presentation. The major potential sources of such massive hemorrhage that need to be considered are the internal carotid artery at the level of the sphenoid and the internal maxillary artery at the level of the pterygopalatine fossa (often results in the formation of an easily recognized hematoma of the buccal space). Initial aggressive nasal packing is required. Once stabilized, internal carotid artery disruption can be diagnosed and treated by angiography-guided intra-arterial balloon occlusion. If this is not completely successful, combined infratemporal fossa and middle cranial fossa approaches to the sphenoid may be required for bypass or ligation of the disrupted internal carotid artery. After initial nasal packing stabilization, the much more commonly noted internal maxillary artery (IMAX) bleeding can be controlled by the application of hemoclips transantrally within the pterygopalatine fossa. An occasionally useful and expedient approach involves approaching the main trunk of the IMAX for ligation intraorally, by identifying it behind the maxillary tuberosity.

The diagnosis of fractures is made by history and physical examination. The diagnosis is confirmed with ancillary radiologic investigations. Uncomplicated nasal fractures do not generally require any radiologic investigations in their treatment plan. Simple dentoalveolar fractures are best visualized with a Panorex or dental periapical examination. Most mandibular fractures may be adequately assessed by obtaining a Panorex (Fig 1). In the past, and presently where CT is unavailable, plain X-rays (Caldwell, Waters,

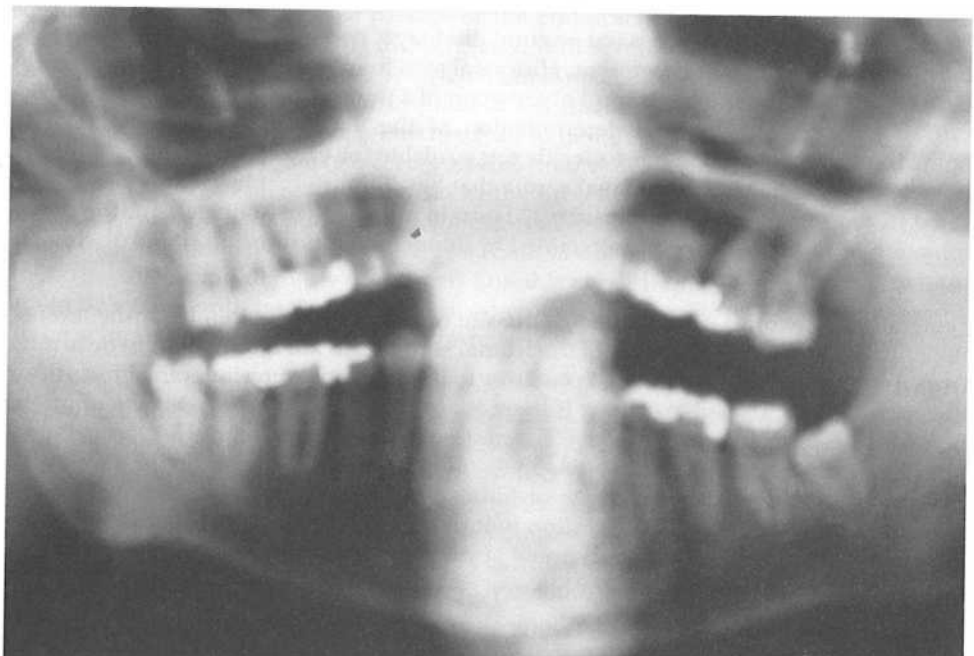


Fig 1.—Panorex of mandible.

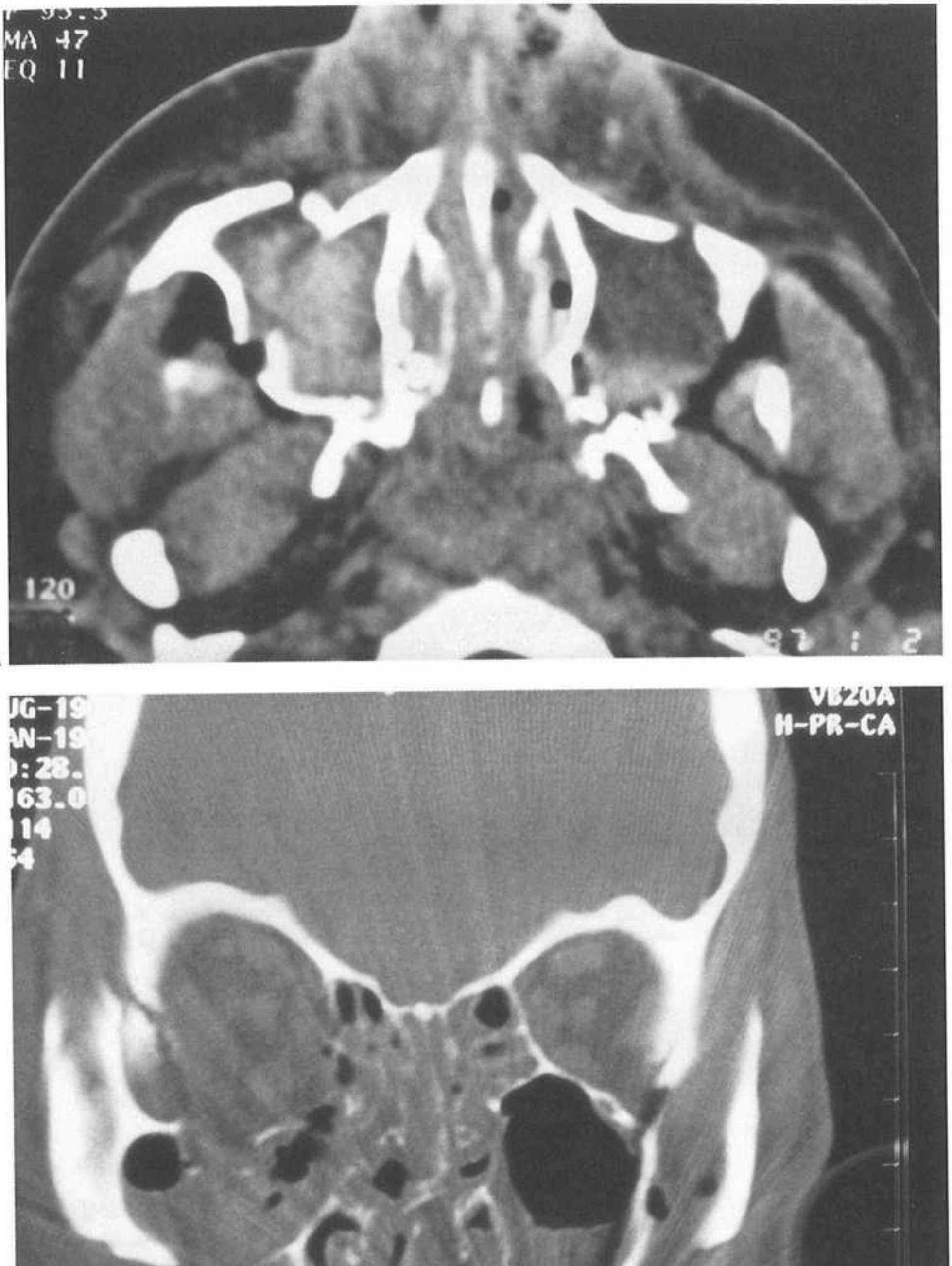
Fig 2.—Waters view of facial bones.

lateral, and submentovertex) were utilized for demonstration of midface and frontal sinus fractures (Fig 2). The vast majority of these fractures can be visualized on plain X-rays. However, CT scanning, in the coronal and axial planes, offers a clearer delineation of the degree of displacement and comminution that may be present. It also allows for visualization of critical areas that are generally not well seen on plain X-rays, such as the orbital apex, posterior wall of frontal sinus, and nasofrontal duct area (Figs 3A and B).

Three-dimensional (dedicated or reconstruction) CT scans assist the surgical planning by providing an excellent spatial orientation of the fractures. It is generally not of significant help beyond a simple CT scan when the degree of displacement is slight. However, when there is a significant amount of displacement and especially when there is a large amount of comminution present, this three-dimensional preoperative view may give the surgeon important surgical guidance, such as the necessity of a more extensive surgical approach than had originally been contemplated or the need for bone grafting. These are all worthwhile considerations, not only in terms of surgical outcomes, but also in the formulation of as clear and thorough an informed preoperative consent as is possible. However, volume averaging in three-dimensional scanning often limits its usefulness as a routine investigation.

Magnetic resonance imaging (MRI) scans are not very useful for delineation of skeletal fractures, but may occasionally be considered in the trauma victim for demonstration of certain intracranial pathologies (e.g., cavernous sinus thrombosis) or in the evaluation of orbital floor fractures. Transporting the intubated patient with multiple trauma into the physically confined space of MRI scanners also poses a significant logistical problem.

Finally, it is important to realize that the occasional unstable patient may not be able to undergo definitive fracture repair for many weeks or months after their trauma. Only after the patient's overall condition has been fully stabilized and all concomitant injuries fully evaluated can treatment of the maxillofacial skeletal injuries be performed.



A

B

Figs 3A-D.—CT scans in axial and coronal planes show critical areas not seen on routine films.

C

D

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