Facial Trauma

John H. Burton and Karen Nolan Kuehl

The major bones of the face create the defining features and include the frontal, nasal, zygoma, maxilla, mandible, and temporal bones. The orbit consists of the maxilla, zygoma, frontal, sphenoid, orbital, and lacrimal bones (Fig. 76.1).

The face is conventionally divided into thirds: upper, middle, and lower. The borders of each third are loosely defined by branches of the trigeminal nerve, which provides sensory innervation to the face. Identification of the exiting foramen for the distributing branches of the trigeminal nerve (cranial nerve V) is crucial when providing local nerve anesthesia (Fig. 76.2).

The facial nerve (cranial nerve VII) intricately courses through the parotid duct and provides parasympathetic innervation, special sensory function to the tongue and soft palate, and general motor function to the 44 muscles of facial expression. Deep facial lacerations between the tragus and lateral canthus may jeopardize the integrity of the facial nerve. Any damage to the facial nerve distal to the stylomastoid foramen can result in facial nerve dysfunction, commonly referred to as Bell palsy.

The parotid duct lies in a plane with the tragus and inferior corner of the nasal vestibule. Competency of the parotid duct must be considered in patients with deep lacerations in this region of the face (Fig. 76.3).

The external carotid artery is the major vascular supply to the face. This vessel provides extensive collateral supply to the midline tissues through anastomosis (Fig. 76.4).

APPROACH TO MULTITRAUMA PATIENTS WITH FACIAL INJURIES

The degree of tissue distortion following facial trauma should not dissuade the EP from addressing the initial treatment priorities in patients. Though uncommon, facial trauma can be a life-threatening insult, and the EP must address life-threatening injuries before evaluating the obvious facial injury. The mere presence of a facial fracture, particularly one involving the midface, greatly increases the risk for traumatic brain injury.11-13 The energy required to fracture the midface is often transmitted to the neurocranium, and such fractures are associated with a high incidence of brain death. In general, patients with facial fractures who do not survive have higher injury severity scores and lower Glasgow Coma Scale scores and consist of an older population. Other typical concomitant injuries include pulmonary contusions, abdominal injuries, and cervical spine injuries.15 The emergence of motor vehicle air bags has decreased patient mortality. However, increased concern is warranted for injuries to the orbits, globes, facial

PERSPECTIVE

A person’s face is the focal point of conversation and social interaction. Within the face is embodied each person’s mode of expression and communication. The face also has a receptive importance, with many special sensory functions of the body located within the facial structures. It is not surprising that facial disfigurement harbors the potential for both physical impairment and long-term psychologic sequelae.1,2

Death from facial trauma is rare, and the severity of facial injuries is often perceived by the patient to be out of proportion to the actual injury. The goal of the emergency physician (EP) is to secure the airway, identify the injury, preserve appearance, and consult with the appropriate surgeon to determine further treatment and follow-up.3 Although zygomatic and nasal fractures may occur in isolation, any fracture of the frontal bone and maxilla must raise suspicion for the possibility of associated facial fractures, intracranial injury, and concomitant cervical spine injury.4-7 Proper diagnosis and recognition of zygoma and nasal pathology are essential for maintenance of adequate cosmetic and physiologic function. Trauma involving the mandible, the strongest facial bone, may result in fracture or dislocation. Fifty percent of mandibular fractures occur at two or more locations because of its pseudo-ring shape. Detection of one fracture site should always prompt a search for a second fracture.8

GENERAL ANATOMY

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KEY POINTS

- Treatment of all facial injuries should initially be directed toward maintaining the airway and stabilizing life-threatening injuries.
- Facial computed tomography is routinely performed to visualize facial fractures; however, plain radiographs may be sufficient in patients with isolated facial injury and a low index of suspicion for a midface fracture or concomitant intracranial injuries.
Treatment of bleeding must begin with inspection of the airway and maintenance of its patency. Local hemorrhage may be controlled with posterior nasal packing or insertion of a Foley catheter into the nasopharynx and inflation with air. The catheter should be gently pulled anteriorly in an attempt to close the posterior choana. Temporary external reduction of fractures may also provide stabilization of arterial injuries. Finally, surgical ligation of the external carotid artery or transcatheter arterial embolization of the maxillary artery can be performed.

The blood supply to the face consists of a complex system involving branches of the internal and external carotid arteries with several anastomoses between them. The majority of the facial vascular supply is via the internal maxillary artery, which originates from the external carotid. The internal maxillary artery passes between the Le Fort fracture lines and can be dissected with severe midface trauma.

Fig. 76.1 Facial bones and essential structures of the facial anatomy.
strikes the dashboard or steering wheel. Assault with a blunt object is also a common injury mechanism.

**ANATOMY**

The frontal bone is the only constituent of the forehead; the prominent protuberance is called the glabella. Within the frontal bone resides the frontal sinus, which communicates with the nasopharynx via the frontonasal canal. The anterior bone of the frontal sinus is thicker than the posterior aspect. The intracranial dura mater is adherent to the posterior frontal sinus wall. Cutaneous innervation of the frontal bone is supplied by the superior orbital nerve, a branch of the trigeminal nerve.

**TREATMENT**

Frontal sinus fractures are usually diagnosed by computed tomography (CT). Displaced anterior wall fractures require either immediate repair or delayed reconstruction. Conversely, frontal bone fractures that involve the posterior wall of the sinus are associated with cerebrospinal fluid (CSF) rhinorrhea; the patient will require urgent consultation with a neurosurgeon and admission to the hospital. Ocular trauma or sudden loss of vision associated with a frontal bone injury requires immediate ophthalmologic consultation.

**FOLLOW-UP, NEXT STEPS IN CARE, AND PATIENT EDUCATION**

Anterior frontal sinus fractures without any concomitant injuries are not life-threatening; the patient can be discharged with close consultant follow-up to maintain an adequate cosmetic result. Although antibiotics have not been shown to decrease the incidence of meningitis associated with a CSF leak and frontal bone fracture, antibiotic therapy should be based on the consultant’s preference.
Hydraulic and buckling theories. The hydraulic mechanism occurs when the vector of the force directed onto an uninjured globe is transmitted to the fixed orbital walls; it results in a large fracture of the inferior or medial orbital wall, or both (Fig. 76.5). This mechanism is commonly associated with herniation of the orbital contents through the fractured orbital wall, hence the term blowout. The buckling mechanism, in contrast, occurs when a traumatic force is directed to the inferior orbital rim and causes only the inferior floor of the orbit to buckle, or fracture, with no associated herniation of the orbital contents.
Herniation of the orbital contents—fatty connective tissue, inferior rectus, and inferior oblique muscles—occurs at the weakest portions of the orbit, specifically, the orbital floor and the anteromedial wall. With increased pressure on the globe, any defect in these bony structures may lead to herniation of the orbital contents and resultant muscular entrapment.

ANATOMY

The globe resides within a cone-shaped socket composed of seven bones of varying thickness. The thinnest bony portion of the socket is the orbital floor. The globe is protected from trauma by the thick superior rim of the frontal bone and the inferior rim of both the maxilla and zygoma. The orbital rim possesses a smooth contour with occasional notching that is symmetric when encountered. Any asymmetric step-off of this rim is indicative of a potential rim fracture.

The eye is cushioned by a retrobulbar fat pad encasing the globe. The extraocular muscles complete the orbital anatomy by surrounding the globe and enabling eye movement. Herniation of any orbital contents through the inferior or medial walls will result in protrusion of these structures, in whole or in part, into the maxillary or ethmoidal sinus, respectively. The inferior rectus and inferior oblique muscles, both innervated by cranial nerve III, lie adjacent to the inferior and medial orbital floors and are the most commonly affected extraocular muscles with a blowout injury.

PRESENTING SIGNS AND SYMPTOMS

Patients with a history of facial trauma should undergo complete evaluation of the eye and the encasing orbit. Initial inspection may reveal peri-orbital ecchymosis and edema, discrepancy in eye level, or enophthalmos. Enophthalmos is consistent with an orbital blowout fracture. Anesthesia of the ipsilateral cheek and upper lip is indicative of inferior orbital nerve impingement.

Key points in the patient’s history include the following:

- Binocular diplopia (blurring of vision when both eyes are open) is indicative of an ocular muscle imbalance between the two eyes as a consequence of muscle entrapment, contusion, or displacement of the globe secondary to edema from surrounding structures.
- Monocular diplopia (blurring of vision when only one eye is open) is often indicative of lens dislocation, hyphema, or partial globe rupture.
- Flashing lights, or floaters, can be consistent with a retinal tear, retinal detachment, or vitreous hemorrhage.
- Any loss of perception of light or identification of colors or the presence of central scotomata without association with pain is indicative of optic neuropathy. Absence of light perception following an orbital fracture is a poor prognostic indicator for recovery of vision.
- Rapid loss of vision in one eye associated with edema, proptosis, and tension on palpation should heighten suspicion for the presence of a retrobulbar hematoma.
- Pain with eye movement is commonly associated with an orbital fracture.

The eye examination should begin with palpation of the orbital rims. The rims should be evaluated for crepitus, a step-off deformity, subcutaneous emphysema, and decreased sensation in the distribution of the inferior and superior orbital nerves.

Pupil size, shape, and light reflex must be examined to assess optic nerve status. Full ocular muscle function is evaluated by slow, directed passive range of motion. Upward gaze palsy with vertical diplopia is consistent with dysfunction of the inferior rectus muscle and suggests entrapment from an orbital blowout fracture. Enophthalmos is common when a large amount of tissue herniates through an orbital floor defect into the adjacent maxillary sinus.

The EP must evaluate both eyes for visual acuity. This examination may be facilitated by using a Snellen eye chart or pocket card or by asking the patient to read the text of a newspaper or other print. Visual impairment should prompt immediate consultation for the suspected injury. If the patient’s injury allows proper positioning and cooperation, a slit-lamp examination is warranted to fully evaluate the conjunctiva, lens, iris, sclera, cornea, and anterior chamber of the globe. Intraocular pressure can be measured. However, if the globe has possibly been ruptured, intraocular pressure assessment should be deferred to an ophthalmologist.

DIAGNOSTIC CRITERIA AND TESTING

If the pretest probability of orbital or ocular damage is low or if CT is not available, a Waters view radiograph of the midface is a screening tool for fracture or resultant blood in the sinus, subcutaneous emphysema, depression of the bony fragments, or the “hanging teardrop” sign whereby herniated globe structures may be visualized in the maxillary sinus roof. If suspicion of orbital or ocular injury is high, particularly when concomitant intracranial or facial injuries are suspected, CT is required to elucidate the extent of the identified injury. This examination should include views of the head, as well as axial and coronal cuts of the midface and orbits.

TREATMENT

Management of blowout fractures is complicated. The presence of an orbital fracture with findings of herniation on clinical or radiographic examination requires immediate surgical consultation to guide the treatment plan. Immediate indications for surgical intervention include muscular entrapment with gaze restriction or acute enophthalmos. Contraindications to surgery include globe rupture, hyphema, and retinal tears. These injuries should prompt emergency ophthalmologic consultation. An ophthalmologist should also be contacted for patients with evidence of lens dislocation, laceration of the cornea or sclera, or rapid loss of visual acuity.

Patients with an isolated blowout fracture may be discharged home with follow-up arranged within 2 weeks to assess for resolution of the swelling. If entrapment is present at follow-up, the patient would require open reduction of the fracture. Even patients with a blowout fracture may have their symptoms improve over a 10-day to 2-week period and may not require surgical intervention.
An increase in retrobulbar pressure from a hematoma or emphysema can lead to acute and permanent loss of vision. Lateral canthotomy can be a vision-saving intervention in this context. This simple procedure is intended to relieve pressure on the optic nerve and, ultimately, preserve the patient’s vision through resolution of the optic nerve traction and ischemia. Immediate ophthalmologic consultation should be obtained to perform the lateral canthotomy; when a consultant is unavailable or if a lengthy response time is anticipated, the procedure should be undertaken by the EP.

Local anesthetic without epinephrine is injected into the lateral canthus. An incision is made in the canthus with a pair of fine, sharp scissors. The incision is made in the canthus at the juncture of the upper and lower eyelids between the globe and the orbital rim. Expulsion and drainage of the hematoma should ensue through the incision site.

**FOLLOW-UP, NEXT STEPS IN CARE, AND PATIENT EDUCATION**

Pain should be controlled as deemed appropriate and antibiotic administration initiated if sinus integrity has been disrupted as evidenced by subcutaneous emphysema or radiographic findings. Prophylactic antibiotics are no longer recommended.

**ZYGOMA INJURY**

**PATHOPHYSIOLOGY**

Zygoma fractures are the result of an anterolateral force applied to the midface by falls, deceleration injuries, or assault by blunt objects, including a fist. The zygoma is a thick bone. A direct blow to the zygoma may not necessarily result in a fracture but instead may transmit the force to adjacent weaker areas of the orbit and maxilla and cause a complex fracture. Inward and downward displacement of the zygoma in relation to its articulating surfaces results in the classic zygomaticomaxillary complex fracture, also called a tripod or malar fracture ([Fig. 76.6](#)).

Comminuted fractures of the zygoma are associated with penetrating trauma, such as gunshot wounds.

**ANATOMY**

The term *zygoma* is derived from the Greek word *zygon*, meaning a yoke or crossbar by which two draft animals are hitched to a plow. The zygoma forms the lateral buttress of the face, inferior and lateral orbital rim, and a portion of the orbital floor. Thus a zygoma fracture, by definition, is an orbital floor fracture.

The zygoma articulates with four bones: the maxilla, temporal bone, frontal bone, and greater wing of the sphenoid. For this reason, a zygomaticomaxillary complex fracture—typically referred to as a tripod fracture—is technically a misnomer.

The zygoma forms part of the superior and lateral aspect of the maxillary sinus, and disruption may lead to subcutaneous air. Numerous muscles attach to the zygoma, the most prominent being the masseter, which consequently results in inward and downward displacement of a zygomaticomaxillary complex fracture and trismus.

**PRESENTING SIGNS AND SYMPTOMS**

Common symptoms with fracture of the zygoma include the following:

- Pain over the affected area
- Difficulty opening the jaw secondary to the origin of the masseter (trismus)
- Paresthesia in the distribution of the inferior orbital nerve ([Fig. 76.7](#))
- Binocular diplopia as a result of entrapment of intraocular muscles

The initial physical examination typically reveals severe edema of the zygoma area with possible inferior displacement of the lateral canthus, periorbital edema, and subconjunctival hemorrhage. The face should be evaluated from the superior and inferior aspects to discern any flattening of the cheek.
relative to the contralateral side. The zygoma should be palpated for evidence of a step-off of the inferior orbital rim, crepitus of the zygoma, or subcutaneous emphysema.

Intraoral examination of the zygoma is accomplished by placing a gloved finger along the superior and lateral aspect of the maxillary molars. If this area is tender or if the finger is unable to pass under the arch, a fracture of the zygoma is likely.

A complete ocular examination should be performed to evaluate for entrapment of muscles and possible orbital fracture. Ten percent to 20% of zygoma injuries will be associated with ocular injury.

**DIAGNOSTIC CRITERIA AND TESTING**

If a nondisplaced, isolated zygoma fracture is suspected, a “jug-handle,” submentovertex plain radiographic view may be sufficient for diagnosis. Otherwise, a Waters view constitutes an adequate screening radiographic study for a more complicated fracture. If the Waters view reveals a zygomaticomaxillary complex fracture or if ocular muscle entrapment is suspected, facial CT scans are required for more complete evaluation of the injury.

**TREATMENT**

Initial management of patients with zygomaticomaxillary complex fractures should include prompt diagnosis and exclusion of ocular muscle entrapment or intracranial injuries. If subcutaneous emphysema is present, antibiotics should be initiated immediately; amoxicillin is an effective first-line agent.23

**FOLLOW-UP, NEXT STEPS IN CARE, AND PATIENT EDUCATION**

Patients with an isolated arch fracture can be discharged with appropriate follow-up. However, patients with greater than 2-mm displacement will typically require open reduction. In contrast, patients with a zygomaticomaxillary complex fracture, any injury with impairment of vision, or substantial concomitant injuries will require admission to the hospital with surgical consultation for consideration of open reduction and internal fixation.

**MAXILLARY AND MIDFACE INJURIES**

**PATHOPHYSIOLOGY**

**LE FORT CLASSIFICATION**

Maxillary fractures resulting from severe blows to the head have traditionally been classified according to the Le Fort classification scheme established by René Le Fort in 1901. Le Fort was a French surgeon who induced trauma in 35 cadaveric heads by striking them with a bat or smashing them against a table edge. Next, Le Fort boiled the heads to remove the soft tissue and documented the fracture lines. In his classic treatise on the subject, Le Fort illustrated three predictable midface fracture lines. These injuries rarely occur in isolation, but they are often used as a reference to describe maxillary trauma (Fig. 76.8).

**Le Fort I (Transverse)**

This midface fracture is the result of lateral force applied to the face. The Le Fort I fracture line extends horizontally above the roots of the teeth and involves only the maxilla. A step-off deformity of the upper palate will be present (if not complete). Rocking of the teeth will lead to motion of the midface, with a sensation similar to that of a loose denture.

**Le Fort II (Pyramidal)**

This injury is the result of extreme force directed to the nose and midface and results in separation of the midface from its articulating structures. The Le Fort II fracture line extends through the inferior orbital rim and over the nasal ridge and separates the upper palate and nose from the remainder of the face.

**Le Fort III (Craniofacial Disjunction)**

A Le Fort III is the most severe type of facial fracture. The facial fracture line is horizontal and extends through the nasal bone and laterally through the orbits. This injury results in separation of the facial bones from the base of the skull.

**ANATOMY**

The maxilla is primarily innervated by the inferior alveolar nerve, which emerges from the inferior orbital foramen. Clues to evidence of a midface fracture may include paresthesias in the region of the inferior alveolar nerve.

The nose is a highly vascularized structure within the maxilla. Severe epistaxis associated with a maxillary injury can lead to airway obstruction. Therefore, hemostasis is essential in the approach to maxillary injuries.
Examination of the midface for instability.

Fig. 76.9 Examination of the midface for instability.

**PRESENTING SIGNS AND SYMPTOMS**

Initial evaluation of a patient with a maxillary injury depends on its severity; findings include severe edema, malocclusion, periorbital ecchymosis, facial asymmetry, a long or “donkey” face, and enophthalmos. Palpation of the maxillary structures may reveal crepitus and abnormal mobility of the structures. Anesthesia over the cheek implies disruption of the inferior orbital nerve.

The EP should place one hand on the patient’s forehead to stabilize the head while grasping the upper palate by the anterior teeth with the other hand. Gentle back-and-forth pressure should be applied while palpating the midface for movement (Fig. 76.9). If motion of the midface structures is detected with this technique, further classification of the extent of the injury should be performed by localization of the nasal ridge or inferior orbital rims with the other hand. If CSF rhinorrhea is suspected, testing the fluid for glucose or the halo sign may be undertaken; however, both these assessments have a high false-positive rate and are considered unreliable. If a fracture is highly suspected or if CT is planned, manipulation of the midface offers little benefit and may cause increased bleeding.\(^{24}\)

**DIAGNOSTIC CRITERIA AND TESTING**

In patients with a high index of suspicion for a facial fracture, neurologic deficit, or severe facial distortion or in those who are undergoing CT evaluation for any reason other than midface trauma, CT of the facial bones with fine axial and coronal cuts should be the initial imaging study.

If no other significant injuries are present and the findings on clinical examination are ambiguous for a facial fracture, a Waters plain radiographic facial view is an excellent screening examination. If plain radiography reveals an obvious fracture or opacification of a maxillary sinus, CT is warranted and should be performed in follow-up or at the time of the initial encounter, as dictated by the needs of the patient and preference of the surgical consultant.

**TREATMENT**

Before a thorough evaluation of the maxilla is undertaken, the EP must first stabilize the patient and ensure that the airway is preserved. Airway compromise is more common with Le Fort II and III fractures but may also be seen with Le Fort I injuries.

Airway obstruction is often secondary to uncontrolled bleeding. Therefore, attempts at hemostasis should be undertaken early in the evaluation. Assessment of facial fracture bleeding should be completed during the “circulation” component of the ABCDE (airway, breathing, circulation, disability, exposure) evaluation technique advocated by the advanced trauma life support protocol. Early oral endotracheal intubation may be required and allows more aggressive control of bleeding.

Nasopharyngeal intubation should be avoided with midface injuries. A surgical airway (e.g., cricothyrotomy) may be necessary because of anatomic damage or excessive bleeding. Placement of an orogastric tube will allow assessment of swallowed blood, which can provide valuable information in a multitrauma patient with developing tachycardia, hypotension, or both.

If hemostasis of the nares cannot be achieved, a Foley catheter should be carefully advanced into the nasopharynx and inflated with air (overinflation may result in septal necrosis). The catheter should be gently pulled anteriorly in an attempt to close the posterior choana. Once the catheter is in place, the nasal cavity can be packed with gauze or nasal tampons for control of anterior epistaxis. The physician must be careful when advancing any tube through the nares because violation of the anterior cranial base can allow passage of the catheter into the cranium. If bleeding is not controlled with Foley catheters and packing, embolization of bleeding vessels with possible surgical exploration and ligation of vessels should occur. Emergency consultation with ear, nose, and throat (ENT), plastic surgery, and interventional radiology services should be considered early if the patient requires angiography. Regardless of the severity of bleeding, all patients with facial fractures should be reevaluated for hemorrhage every 30 minutes for a period of up to 6 hours.\(^{25}\)

**FOLLOW-UP, NEXT STEPS IN CARE, AND PATIENT EDUCATION**

Antibiotic prophylaxis for basilar skull fractures has not been shown to decrease the risk for meningitis.\(^{26}\) However, prophylactic antibiotic regimens may still be used in an attempt to prevent translocation of mouth and sinus flora.\(^{27}\)

Evidence of a basilar skull fracture or pneumocephalus requires prompt neurosurgical consultation. Maxillary fractures often require surgical repair to restore normal occlusion and facial stabilization, and thus consultation and follow-up with an oromaxillofacial or plastic surgeon is important. Patients with demonstrated or suspected Le Fort II or Le Fort III injuries require hospital admission for stabilization and management.
Each naris must be inspected carefully with a nasal speculum to evaluate for a septal hematoma. A septal hematoma is a collection of blood between the mucoperichondrium or mucoperiosteum of the nasal septum and septal cartilage. A septal hematoma appears as a purple, bulging oval structure on the nasal septum that invades the midline (Fig. 76.10). Failure to promptly identify and treat a septal hematoma can lead to necrosis of the septum and potentially a saddle nose deformity.

A nasoorbitoethmoid fracture should be suspected in patients with flattening of the bridge of the nose or telecanthus (an increase in the distance between the medial portions of the eyes). Patients may have evidence of ocular injury and CSF rhinorrhea. Additionally, disruption of the lacrimal apparatus is not uncommon with more severe nasal injuries.

Plain radiography is of limited value in patients with simple nasal trauma and has no clinical implication in management. Patients can be reassured that radiographs may be obtained at follow-up if any cosmetic deformity persists and surgical repair is required. If the physician is concerned that a nasoorbitoethmoid fracture is present, axial and coronal CT of the face is necessary.

The EP should not attempt reduction of closed nasal fractures. Given the extensive edema that generally ensues before the patient arrives at the emergency department (ED), the EP will be unable to approximate realignment of the nasal septum. Epistaxis should be dealt with during the clinical evaluation. Analgesia should be adequately addressed during the patient’s visit and at follow-up.

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Nasal bone fractures are commonly the result of sports-related trauma, assault, and motor vehicle crashes. The force required to fracture the nasal bone ranges from 16 to 66 kPa, the least of any facial bone. Simple deviated nasal fractures are the result of a lateral force against the nasal prominence. More complex nasoorbitoethmoid fractures are due to a stronger force directed toward the bridge of the nose with displacement of the bone segments posteriorly. This type of fracture is frequently associated with other facial and brain injuries.

The nasal bone consists of two small wedge-shape bones that are fused in the midline and protrude from the frontal process of the maxilla laterally and frontal bone superiorly. The upper portion of this paired structure is significantly thicker than the lower segments, thereby leading more commonly to fractures of the latter. The external nose is composed of cartilaginous and fatty tissue and has an intricate blood supply from distal branches of the internal and external carotid arteries.

Patients with nasal trauma have complaints of tenderness, edema, epistaxis, and periorbital ecchymosis. Palpation of the area can reveal crepitus, hypermobility, and deformity of the nasal septum.
plastic surgeon within 1 week of their injury for reevaluation and planning of management. Patients may also be educated that if no deformity is apparent after the swelling has subsided, ENT follow-up is unnecessary. Children with nasal fractures should be seen in follow-up within 4 days because of rapid bone healing. Patients should be instructed to avoid blowing their nose given that subcutaneous emphysema may ensue as a result of displacement of air across the injured nasal structures.

Emergency consultation for consideration of nasal reduction is indicated if the nasal pyramid is deviated greater than half the width of the nasal bridge or if an open septal fracture has occurred. Open nasal fractures require immediate attention because cartilage necrosis may ensue if the exposed cartilage is not covered within 24 hours. Naso-orbito-ethmoid fractures require a multidisciplinary approach, including oromaxillofacial, plastic, and neurosurgical consultation.

If a septal hematoma is identified, immediate evacuation is required. The nasal passage on the affected side is prepared via topical anesthesia and injection of lidocaine into the anterior septum. The hematoma is initially drained with a large-bore needle at the inferior aspect. The needle track is then enlarged with a No. 15 surgical blade. Next, the anterior nares are tightly packed bilaterally in an attempt to reappose the septal mucosa. Patients with septal hematoma should routinely be prescribed a course of antibiotics and otolaryngologic follow-up arranged within 4 days to assess the injury for evidence of reaccumulation of the hematoma. On discharge, patients need to be educated that any reaccumulation of septal hematoma will require emergency reevacuation. In addition, these patients need to be educated to avoid blowing their nose.

LOWER FACE INJURIES

PATHOPHYSIOLOGY

The location of mandibular fractures has some correlation to the insult received. High-velocity forces directed to the chin result in symphysis or condylar fractures (or both), and a high proportion of these injuries result in comminuted fractures. In contrast, assault-related injuries are more commonly associated with fractures of the angle and ramus. The location of trauma impact does not necessarily correlate with the location of the fracture site because the force of the impact can be transmitted to a distant area.

Dislocations of the mandible can be due to trauma, excessive mouth opening (yawning), seizure, or a dystonic reaction from medication. The mandible dislocates anteriorly and then superiorly, with spasm of the jaw muscles preventing realignment. Unilateral dislocation causes deviation of the mandible away from the affected side. Bilateral dislocation results in an open jaw and underbite appearance.

ANATOMY

The mandible is a horseshoe-shaped bone and appears similar to the letter L from a lateral view (Fig. 76.11). It has 16 tooth sockets innervated by the inferior alveolar nerve. The mandible articulates with the temporal bone bilaterally via a ginglomothermal hinge and sliding joint to form the temporomandibular joint. The arterial supply to the mandible is via branches of the maxillary artery.

Fig. 76.11 Anatomy of the mandible.
The temporomandibular joint consists of the mandibular condyle process and the mandibular fossa of the temporal bone interspersed with a cartilaginous disk and surrounded by a joint capsule. If the jaw is opened slightly, the hinge action predominates as the condylar process rotates within the socket. However, as the jaw is opened wider, the mandibular condyles glide forward to the articular tubercle of the temporal bone. Overextension of the joint results in anterior dislocation of the mandibular condyle process and subsequent spasm in the masseter and pterygoid muscles, which prevents normal mouth closure.

**PRESENTING SIGNS AND SYMPTOMS**

Typical initial symptoms of a mandibular injury include mandibular pain, abnormal jaw motion, malocclusion, and paresthesia of the ipsilateral lower lip secondary to disruption of the mandibular nerve. Patients often state that their “bite is off,” a sign of displacement or malocclusion of the mandible or maxilla. If the patient reports pain in the preauricular area, fracture of the condyle is frequently present.

Examination of the mandible should begin with visual inspection for edema, deviation with passive range of motion, and a “widened face,” an indication of a bilateral condylar fracture. The EP should palpate the outside of the face to ensure preservation of the smooth contour of the mandible. During the intraoral examination, clues to a mandibular fracture include ecchymosis of the floor of the mouth and mucosal tears. Any obvious separation of the lower teeth or step deformity is pathognomonic for fracture.

The EP inspects the temporomandibular joint by first performing an otoscopic examination for signs of perforation of the external ear canal or hemotympanum. A Battle sign is indicative of perforation of the glenoid fossa by a fractured condyle. Next, the examiner’s fingers are placed in the external canal, and the patient is instructed to open and close the mouth. Tenderness or crepitus elicited with this examination is indicative of a condylar fracture.

If the clinical findings are misleading, one can perform the tongue blade test, which has been demonstrated by Alonso and Purcell to have high sensitivity in screening for mandibular fractures. The test is performed by placing a wooden tongue blade between the molars (Fig. 76.12). The patient is instructed to bite down, and the examiner exerts a twisting motion in an effort to crack the wooden blade between the patient’s teeth. If the EP is unable to crack the blade between the patient’s teeth during the twisting motion—because of pain or malocclusion—a positive test is confirmed with subsequent enhanced suspicion for a mandibular fracture.

**DIAGNOSTIC CRITERIA AND TESTING**

Initial radiographs should include lateral and posteroanterior views and a Towne view of the mandible (if Panorex is unavailable). If the index of suspicion for a condylar fracture is high despite normal radiographic findings, CT with fine cuts of the condyle will be necessary to definitively rule out a fracture. If evidence of an avulsed tooth is present on clinical examination, a chest radiograph should be obtained to evaluate for aspiration.

**TREATMENT**

Initial management of a mandibular fracture should ensure that the patient can maintain a patent airway without difficulty. Pain relief may then be obtained with nonsteroidal antiinflammatory drugs and narcotic agents. Because of the potential for wound infection from mouth flora, patients with open mandibular fractures should be treated with oral or intravenous penicillin. Clindamycin is an excellent choice for penicillin-allergic patients. Stabilization of a displaced mandibular fracture can be achieved with a Barton bandage.

When traumatic temporomandibular joint dislocation is encountered, the EP must obtain a dental panoramic study to consider the presence of a concomitant condylar fracture. If no indication of fracture is present, an attempt at reduction of the mandible in the ED may be undertaken with provision of intravenous benzodiazepines, as well as occasional procedural sedation and analgesia, to relax the muscles of mastication.

To perform reduction, the EP’s thumbs are wrapped in gauze (to prevent injury). The EP faces the patient and places the thumbs on the posterior molars of the patient’s mandible; the remaining fingers are wrapped around the inferior border of the mandible. Force is directed down on the thumbs as the symphyseal area is raised toward the EP. If reduction is unsuccessful, the patient may require general anesthesia. After reduction of an acute dislocation, the patient should be placed on a soft diet and instructed not to open the mouth wide for 7 days.

**FOLLOW-UP, NEXT STEPS IN CARE, AND PATIENT EDUCATION**

Any patient with an open or unstable mandibular fracture requires admission for occlusion fixation or mandibular wiring. Patients with stable fractures may be discharged home and instructed to maintain a soft diet, and prompt outpatient follow-up should be arranged with an otolaryngologist or oral surgeon. Edentulous patients usually require admission to the hospital and internal fixation because they do not have teeth to assist in stabilizing the fracture. Phone consultation with an oromaxillofacial or plastic surgeon is essential to formulate an appropriate treatment plan.
PRIORITY ACTIONS

Suspicious mechanism of injury? Is the patient being physically abused? Unwitnessed head, neck, and facial injuries, particularly in women, should raise concern for interpersonal violence.
- Obtain a history with only the patient in the room, and ask directed questions concerning the mechanism of injury and patient circumstances.
- Contact appropriate resources if the patient confirms a history of physical abuse.

Typical concomitant injuries in a patient with facial trauma include contusions, intracranial pathology, and abdominal and cervical spine injuries.
- In patients with severe facial injuries, consider elevating the head of the bed to reduce facial soft tissue swelling and possible airway compromise.
- Reassess the patient for hemorrhage from a facial fracture on arrival and at 30-minute intervals up to 6 hours.

Is the patient experiencing sudden loss of vision or eye pain? Increased retrobulbar pressure from a hematoma or emphysema can lead to acute and permanent loss of vision.
- Lateral canthotomy can be a vision-saving intervention.
- Loss of the perception of light or the ability to identify colors without associated eye pain is indicative of optic neuropathy.
- Emergency consultation with an ophthalmologist and computed tomography of the orbits and globes are required when considering optic nerve impingement.

Pain with eye movement? Does the patient have muscle entrapment?
- Perform computed tomography of the maxilla and orbit when considering a blowout fracture of the orbit.

Loss of sensation in the nerve distribution?
- Superior orbital nerve: consider a superior orbital rim or frontal bone fracture.
- Inferior orbital nerve: consider a zygoma, inferior orbital rim, or maxillary fracture.
- Mandibular nerve: consider a mandibular fracture.

Does the patient have malocclusion? Consider a mandibular or maxillary fracture.
- The tongue blade test is useful as a clinical screening examination for mandible fractures.

Lacerations through the vermilion border require extra attention to detail with surgical closure. Slight misalignment at the time of wound closure may result in substantial cosmetic implications.

Competency of the parotid duct must be considered with all deep cheek lacerations.

Do not attempt to realign a fractured nose in the emergency department.

Does the patient have a septal hematoma?
- A septal hematoma requires immediate evacuation, application of a wound dressing, prophylactic antibiotics, and close follow-up for wound care.

Does the patient have an otohematoma?
- Otohematomas should be drained and an adherent pressure dressing applied to prevent reaccumulation.

Is the patient’s tetanus immunization up to date?
- Prophylactic antibiotics should be considered in patients with grossly contaminated wounds, open fractures, and joint wounds; in immunocompromised patients; with delayed wound closure; with high-velocity gunshot wounds; and in patients at high risk for endocarditis.

DOCUMENTATION

A detailed cranial nerve examination should be documented with special attention paid to the following:
- Ocular movements
- Sensory examination of the face
- Visual acuity
- Cervical spine “cleared” by clinical or radiographic criteria
- Absence of septal hematoma with a history of nasal trauma

SUGGESTED READINGS


REFERENCES

References can be found on Expert Consult @ www.expertconsult.com.
Chapter 76: Facial Trauma

REFERENCES

2. Wu V, Huff H, Bhandari M. Pattern of physical injury associated with intimate partner violence in women presenting to the emergency department: a systematic review and meta-analysis. Trauma Violence Abuse 2010;11:71-82.