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Part I of this series focused on an overview of facial fractures, life-threatening injuries, and general wound repair. This second part will cover trauma to the forehead and scalp, eyes, and nose. Part III will discuss trauma to the mandible, mouth, and ears.

—The Editor

The Facial Trauma Patient in the Emergency Department: Review of Diagnosis and Management

Part II: Orbital and Nasal Trauma

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Forehead and Scalp

Wound Repair: Scalp. The scalp extends from the temporalis muscles laterally to the external occipital protuberance posteriorly and to the supraorbital ridge anteriorly. Although the forehead actually is part of the scalp, wounds there are treated like facial injuries not like scalp injuries (*see next section*). While there are five actual anatomic layers of the scalp (i.e., skin, superficial fascia, galea aponeurotica, subaponeurotic connective tissue, and periosteum), from a clinical standpoint there are only three. The first three layers essentially are fused as one outer layer. This outer layer contains many arteries and veins, giving the scalp its renowned blood supply. The superficial fascia is strong enough to hold these vessels open and cause profuse bleeding that at times seems out of proportion to the size of the laceration. Even smaller lacerations have the potential to produce hypovolemia and hypotension if bleeding is not controlled. Emissary veins drain from the scalp into the skull. While scalp wound infections are uncommon, one must realize their serious nature as they put the patient at risk for meningitis, brain abscess, and osteomyelitis.[1]

Bleeding from scalp wounds can be controlled with several methods. The tried and true approach of direct pressure is the quickest and easiest way and should be used first. After removal of any obvious gross contamination or foreign bodies, a pressure bandage can be applied using clean gauze and elastic (ACE) wrap. One should avoid the temptation to suture bleeding scalp vessels as they are surrounded by dense fibrous tissue that often prohibits success. Leave the bandage in place for 30-60 minutes. Bleeding often can be controlled with this technique.[2] As up to 50% of patients with scalp wounds will have alcohol on board,[3] leaving the pressure bandage in place also can give the patient time to calm down. An equally useful alternative approach in cooperative patients is to just close the wound,[1] which is the next step if pressure bandaging fails. Although not as quick, using 3-0 suture and taking deep bites through the skin, subcutaneous fascia, and galea in one bite may be more effective than stapling, as this applies more pressure to vessels in the fascia than staples. It also has the advantage of incorporating galeal closure without using buried sutures (*see below*). It can be helpful to have an assistant apply direct pressure adjacent to the wound to reduce bleeding during closure. Other approaches described include placing a wide, tight rubber band circumferentially around the scalp to act as a tourniquet or using a hemostat to evert the wound edges. If using hemostats, minimize the time they are applied to avoid unnecessary injury to the wound edge. Life-threatening bleeding can result from scalp wounds and can be controlled with Raney scalp clips. They are used by neurosurgeons to control hemorrhage from scalp incisions, can be obtained from the operating room (OR) at many hospitals, and are safe and relatively simple to apply using their applicator.

Once bleeding is controlled, the wound should be inspected to ascertain the type and number of wounds as well as depth of injury. Clean the hair off any clotted blood. It is rare for the cleaned wound not to end up significantly larger than it first appeared. Be aware also that clotted blood easily can hide associated lacerations present in addition to obvious wounds. Take time to thoroughly inspect the area around the wound as well. Likewise, inspect under any flaps for occult foreign bodies that may be pushed far from the wound edge. One should palpate the skull if exposed for any defects or fractures. Be aware that periosteum laceration may simulate skull fracture by palpation. While there are cases where plain skull films can be more sensitive for fracture than computed tomography (CT) scan, the presence of skull fracture alone does not correlate well with intracranial injury.[4] Since brain injury can be present with or without skull fracture and is much more serious than a scalp wound, use of CT scan instead of plain films is recommended when evaluating head trauma patients.[5]

Depth of injury often is apparent from visual inspection of the clean wound. Wounds that gape significantly have disrupted the full outer layer composed of skin, subcutaneous fascia, and galea. Wounds that are not gaping have an intact galeal layer and can be closed with surface suture or staples alone. Although easily done, one should take care not to mistake periosteum for the galea, which does not require separate closure. Little controversy exists on whether or lacerations of the galea should be closed. It serves as the anchor for frontalis muscle and, if anterior galeal defects are not closed, resulting asymmetric contractions can distort facial expression. Seemingly well-approximated lacerations of the scalp can have disappointing results if the patient is left with asymmetric forehead movement. Closure of the galea on posterior scalp gains no real cosmetic benefit, but should be done for larger lacerations (larger than 3-4 cm) to protect subaponeurotic connective tissue from infection.[2] To close the galea, one can either use a 3-0 large, non-absorbable suture taking single large bites of the outer layer (skin, fascia, and galea) all together, or place separate absorbable deep sutures for a layered closure. Deep sutures should be used for wounds near the forehead and for larger (larger than 5 cm) wounds as they provide a more secure closure. Horizontal or vertical mattress sutures also work well for single layer closure. Sutures also should be selected over staples in areas of potential future hair loss that can expose scars.

Some final tips for scalp wound closure are as follows. Keep

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hair out of the field with ointment or trim in a 1 cm perimeter around the wound. Do not shave hair to the skin as this has been shown to increase wound infection.[6] One can even use hair to close the wound by isolating an appropriate amount on either side and tying it in a knot across the wound.[7] This can be popular in children as it avoids using any needles, but the hair must be long enough to tie. Minimize debridement of what may appear to be devitalized tissue. Often the vascularity of the scalp will allow healing in spite of initial appearance, and the naturally tight nature of the scalp will not stretch to close wider wounds without unacceptable tension. Stellate lacerations are common on the scalp as a result of blunt trauma, and corner stitches work well to re-approximate these injuries. When placing staples in the scalp, carefully line up the skin surface edges. It is easy to overlap the scalp skin when taking uneven bites with larger staples, which results in uneven scars and ingrown hair. Think about the person who will be removing your sutures by leaving 1-2 cm tails on stitches and using blue suture on the scalp. Large avulsed scalp pieces should be treated with the same protective approach as for extremity amputations for expected re-implantation (i.e., minimal handling, cooled to 4°C, etc.). Lastly, there generally is no fixed time limit after which scalp wounds cannot be closed after thorough cleaning.[1]

Once repaired, scalp wounds should be dressed and a thin layer of antibiotic ointment applied. The patient can wash normally after 24 hours, and sutures/staples should be removed in 7-10 days. A mild compression bandage may be placed over wounds where hemostasis is an issue and left in place for 24 hours. This will reduce risk of re-bleeding and hematoma formation that can compromise large areas of the damaged scalp to the point of skin grafting.

Forehead. Though technically part of the scalp, forehead wounds are closed similarly to other facial wounds. Unlike with the scalp, staples are not to be placed on the forehead as they will increase scarring and do not permit the precise wound alignment required. Unfortunately the forehead is both a common site for injury and highly visible in terms of scarring. Figure 1 shows examples of key suture placements that reduce scarring by proper alignment of surface landmarks. Skin tension lines run horizontally across the forehead, and wounds perpendicular to the tension lines will produce wider scars despite good closure. Placing deep sutures is unlikely to prevent ultimate scar widening, and excess deep sutures more likely will increase scar size by increasing inflammatory reaction in the thin forehead skin. Deep wounds, however, do require layered closure for re-approximation of frontalis muscle fascia to prevent distorted facial expression from asymmetric muscle contraction. Likewise, large periosteal defects should be closed grossly to prevent adhesion of skin to the skull, which also disfigures expression. Try to strike the best balance between appropriate wound closure and use of the least number of deep sutures. When placing deep sutures, use smaller 5-0 or 6-0 absorbable sutures.

Forehead blocks can provide a good alternative to multiple painful injections with larger or numerous wounds. (*See previous section on Nerve Blocks in Part I.*) Simple lacerations should be closed using fine suture (6-0) and by placing stitches close to the wound edge. Taking large bites and placing sutures wider than 5 mm is not recommended. When treating wounds with ragged edges, be very careful with debridement. Little excess tissue exists on the forehead, and excising wound edges can lead to a wound with clean edges that no longer will close. Eyepiece magnification (Loupes) is recommended for precision. On the other hand, any foreign material that is in the wound should be removed to reduce potential for tattooing. Consultation should be obtained if one feels removal of damaged tissue or embedded debris could prevent wound closure.

Lastly, large tissue flaps can be created on the forehead from blunt trauma. While in the emergency department (ED) their closure may seem straightforward, these injuries are prone to the trap-door effect,[1] which results in elevation of the flap with scar maturation. Vascular congestion and natural scar contraction both add to inevitable elevation of the flap above surrounding tissue. Secondary procedures to reduce this effect often are required, and consultation for closure in the ED is recommended.

Deep Structure Injury

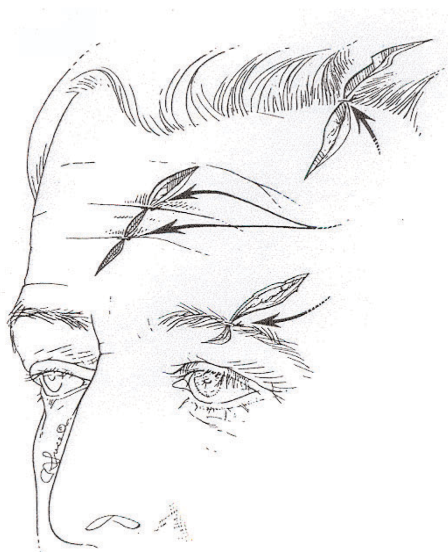
Frontal Sinus Fracture. Due to the high forces required, frontal bones are fractured less often than other facial bones. As one would expect, the forces involved and the proximity of the brain make frontal sinus fractures high risk for associated brain injury.[8] Frontal sinus fractures also are associated with other facial bone fractures as well, and anyone diagnosed with a frontal sinus fracture should have CT of the head and face to evaluate for other associated injuries.

The frontal bone essentially is a subcutaneous structure, and step-offs sometimes can be felt when palpating inside a forehead laceration. Depression of the supraorbital ridge also may be obvious on visual inspection, or fractures may be visualized when exploring the wound. Both plain films and facial CT usually show frontal bone fractures well. The key distinction to make is the integrity of the posterior sinus wall. If just the anterior sinus wall is fractured, it likely will require surgical elevation to restore cosmesis, but this can be delayed without affecting outcome. These patients should have their wounds closed, be given prophylactic antibiotics (cephalexin [Keflex] 500 mg QID), and referred for outpatient repair. New endoscopic techniques and use of bioresorbable plates and screws dramatically have improved surgical approaches to frontal sinus surgery.[9] Posterior wall fractures are a different matter entirely, as one must presume a dural tear exists. These patients require admission (usually to a neurosurgeon) and maintained elevation of the head to reduce cerebrospinal fluid (CSF) loss.

Orbital Trauma

Eyebrow and Eyelid Wound Repair. Eyebrow lacerations are common as the recessed position of the eye effectively protects the globe at the expense of the surrounding tissue. These wounds usually are repaired easily and produce well-hidden scars as long as a few basic rules are followed. First, don't debride viable tissue here no matter how jagged the edges. Excision of tissue will remove hair follicles with it and create more

Figure 1. Key Forehead Sutures



As with closure of the vermillion border, there are key cosmetic sutures to place on the forehead. The hairline and the eyebrow margins must be re-approximated first, as well as major forehead wrinkles, to minimize the effect of scars on appearance. Reprinted with permission from: Tintinalli J, et al, eds. *Emergency Medicine: A Comprehensive Study Guide*, 6th ed. New York: McGraw-Hill Inc.;2004:301.

alopecia along the scar, thus reducing the ability of eyebrow hair to cover the scar. Second, if debridement is performed, make sure to orient the scalpel parallel to the hair shafts to remove as few hair follicles as possible. Third, just use saline for irrigation of these wounds. No matter how careful one is, whatever solution is used is likely to spill into the eye. Fourth, be sure to line up points on the edges of the eyebrow to ensure the brow margins are aligned correctly. (*See Figure 1.*) As with the vermillion lip border, these sutures should be placed first, even before deep sutures (if used). A single stitch at each eyebrow edge usually will ensure proper alignment. Fifth, eyebrow hair never should be shaved. Landmarks for the brow margins will be lost, and regrowth of shaved eyebrow hair is slow and unpredictable. Permanent unwanted loss of eyebrow hair can be more of a cosmetic problem than the scar itself.

Eyelid lacerations also are relatively common but have more risk than eyebrow wounds. From the beginning one should rule out globe injury before attending to the eyelid itself. One must visualize the affected eye early on in treatment to rule out more serious globe injury. If already swollen shut, one must open the eyes (i.e., with folded paper clips, fingers, etc.) to assess eye function. Gross visual acuity (finger counting), pupillary response, and intact eye movements are the most basic and important eye functions, and their presence should be documented. Double vision suggests blowout fracture with entrapment if binocular, but suggests lens dislocation if monocular. If acuity, pupil response, or movements are grossly abnormal or absent, evaluation of the globe injury takes precedence over any eyelid trauma (*See section on Orbital Trauma: Globe Injuries*).

The upper eyelid more commonly is injured than the lower. Small vertical wounds there often heal well and hide the scar well in natural skin folds. As with the eyebrow, irrigation solutions are likely to spill into the eye, so saline is the safest choice. Be careful to use small needles (27-30 gauge) for injection of anesthetic, and inject small volumes. Like the lips, the eyelids can be distended dramatically by over-injection complicating wound closure. Use smaller suture (6-0 or 7-0) for surface closure and take only superficial skin bites to avoid deep penetration of the needle through the lid into the globe. Any vertical laceration on the eyelid should be examined carefully for involvement of the lid margin. Careful repair of a full-thickness lid laceration is critical for its continued normal function. Corneal wetting and subsequent delivery of nutrients and oxygen are dependent on good approximation between the lid and the eye itself. Misalignment can compromise corneal health, and notching or lumping of the conjuctival surface of the lid can abrade the cornea, leading to significant discomfort and injury. Wounds that cross the lid margin are best left to the consultant, as they are at high risk of abnormal eversion (ectropion—everted conjunctival mucosa exposed) or inversion (entropion—the margin and eyelashes contact the cornea) if not closed properly.

As a general rule, wounds deep enough to make one think of layered closure also are good candidates for closure by the consultant. Deep eyelid wounds are at high risk for a number of potential complications: open globe, traumatic ptosis, hyphema, retained foreign body, etc. (*See next section on Orbital Trauma: Deep Structure Injury.*) Injury to the tarsal plate (either upper or lower lid) requires repair and often is associated with an open globe. If one sees fat protruding into the eyelid wound, it is likely retrobulbar fat which, by definition, can appear only through a tarsal plate defect. The tarsal plate also serves as an attachment site for the levator palpebrae muscle, and laceration of either structure causes traumatic ptosis that may not be evident clinically until eyelid swelling subsides. Lacerations medial to the punctum are high risk for involvement of the lacrimal duct, which must be cannulated as part of the repair. (*See next section.*) It is easy to forget that there is an opening for the tear duct on both the upper and lower lids. Most physicians may think only of the punctum on the lower lid when ruling out tear duct injury. Excessive tearing of only one eye can be a clinical clue that the duct is severed. Wounds in this area also can involve the medial palpebral ligament, which results in lateral displacement of the entire lid structure and gives the patient a “cross-eyed” appearance. Lacerations on the inner surface of the eyelid should be referred as well. Finally, any sizeable loss of lid tissue obviously requires consultation for reconstruction.

After closure of eyebrow or eyelid lacerations in the ED, the wounds can be covered with a thin layer of antibiotic ointment and otherwise not bandaged. If the eye is swollen shut (and globe injury ruled out), it can be helpful to place some ophthalmologic antibiotic ointment under the lower lid at discharge. This will help to prevent infection since the tears will not be able to clean the eye normally until the swelling resolves. Follow-up with an ophthalmologist within 2-3 days is advised.

Lacrimal Duct/Canalicular Injuries. The canaliculi are small tubes that carry tears from the punctum and join together to form the lacrimal sac, located on the inner surface of the medial orbital wall. The sac connects to the nasolacrimal duct, which travels inside the facial skeleton to drain fluid into the nasal cavity. The sac extends about 3-5 mm above the medial canthus. Deep lid lacerations in the medial aspect of either upper or lower lid are at high risk for involvement of the canalicular system and/or lacrimal duct. The canaliculi function to drain tears from the eye, and begin with an opening (punctum) found at the medial most aspect of each lid. It used to be thought that lower lid punctum drained the majority of tears from the eye, but later research has shown both carry a significant portion of tears from the eye.[10] Since both canaliculi need to remain intact for proper tear drainage, all canalicular injuries are repaired surgically.

Both blunt and penetrating trauma can result in canalicular lacerations. The most commonly injured site is the horizontal section of the duct on the lower lid. It is imperative to recognize these injuries on presentation to the ED as primary repair is highly successful in restoring function, but once the canalicular system is scarred, it is much more difficult to achieve a functional repair. One should remember that the canaliculi are only 1-2 mm in diameter, and seemingly insignificant surface wounds can be associated with canalicular injury.

Any patient with a possible canalicular or lacrimal sac/duct injury requires consultation by an oculoplastic surgeon while the patient is in the ED. Examinations for duct injury are best performed only by a specialist with training in this procedure. These wounds are best diagnosed by probing and irrigation of the system with fluorescein dye to identify small leaks. This can be performed on cooperative patients in the ED, but uncooperative or pediatric patients will require OR sedation. Once identified, canalicular lacerations are repaired by stenting the canaliculi with silicone tubing and repairing the surrounding tissue (not the ducts themselves). The silicone tubing is removed after two months. Most surgeons repair these injuries within 24-48 hours,[10] so if the patient has an obvious, isolated canalicular laceration, it is possible that the patient could be discharged from the ED for scheduled repair in the next 1-2 days. Given that the repair must occur during this time frame, one should do this only with very reliable patients and document the instructions given at the time of discharge. One would never do this, however, without phone consultation with the follow-up surgeon while the patient still is in the ED.

Globe Injuries. Trauma to the globe can produce a variety of injuries that the EP must be able to diagnose. Up to 2.4 million traumatic eye injuries occur every year in the United States.[11] A detailed eye exam systematically will evaluate the eye for injury. One should always check visual acuity starting with light perception, finger counting, and testing with a Snellen chart. Remember to evaluate the lid for injuries, but also for occult foreign bodies that may be hiding underneath. One also should document pupillary reaction, eye movements, and absence of blood in the anterior chamber (hyphema); fluorescein stain the cornea for abrasions; and look in the posterior chamber for retinal detachment or vitreous hemorrhage. Intraocular pressure (IOP) can be measured if there is no suspicion of an open globe (*see below*).

Open Globe. Ruptured or open globe injury probably is the most serious condition that must be considered when a patient presents with orbital trauma. Anyone with a penetrating injury around the orbit or eyelid lacerations (especially if involving both upper and lower lids) is at high risk. Always remember to examine both eyes, even if one seems uninjured. One should be aware that most penetrating trauma causes an immediate loss of vision, but that smaller, high velocity objects can penetrate the globe without changing visual acuity. Hammering and grinding metal with power tools can cause this type of injury. Blunt trauma also can cause globe rupture by suddenly increasing IOP. Blunt ruptures typically occur at the insertion of the intraocular muscles or at the limbus (junction of cornea and sclera) where the sclera is thinnest. The prognosis with blunt trauma is worse than with penetrating trauma because of a higher frequency of retinal detachment in blunt injuries.

Clinical signs of open globe can be obvious: irregularly shaped pupil (from herniation of iris through defect), shallow anterior chamber, hyphema, and vitreous hemorrhage. In other cases, signs of open globe are minimal and easily can be missed. Low IOP is a reliable sign of an open globe, but one never should perform tonometry in obvious cases of open globe. Any maneuver that may increase IOP must be avoided to prevent further extrusion of intraocular contents. Likewise, an abnormal view of the optic disc indicates an open globe, but one should not instill any drops (i.e., cycloplegics, antibiotics, etc.) when there is a known or suspected globe rupture. Very small children even may require anesthesia for their initial examination with significant eye trauma. Orbital foreign bodies can be associated with open globe as well. (*See section on Foreign Bodies.*)

The only ED test that can help identify an open globe if one is unsure of the diagnosis is the Seidel test. This is performed by introducing a large amount of fluorescein dye into the eye and looking for a small stream of fluid leaking from the globe. The fluorescein helps identify the small stream of otherwise clear fluid by changing the color of the background fluid. While very helpful if positive, a negative test does not rule out a rupture that is small enough to seal and not be actively leaking intraocular fluid. When suspicion exists for globe injury, the ophthalmologist will need to rule out occult globe injury if it cannot be diagnosed by the ED physician. CT scan of the orbit, ultrasound, or indirect IOP measurement all may be used by the consultant to make a definitive diagnosis.

Treatment requires urgent ophthalmology consult as open globe injuries typically require surgical repair. Before going to the OR, the patient should have his or her head elevated, have a protective metal shield placed over the eye, have a tetanus booster (if indicated), and receive instructions not to touch the globe. The patient should be kept NPO, and should be given prophylactic antibiotics (cephalosporin) and anti-emetics as vomiting will increase IOP.

Corneal Abrasions/Foreign Bodies/Ulcers. Corneal abrasions are very common and occur from a variety of mechanical causes. The patient may have a history of scratching the eye or complain of a foreign body in the eye. The cornea is highly innervated, so even the smallest of abrasions to the cornea can be exquisitely painful. Besides pain, patients typically complain of foreign body sensation, blurred vision, and may have photophobia. Clinically, the sclera appears red and injected, and excessive tearing is present. Application of topical anesthetic (i.e., tetracaine drops [Pontocaine]) should provide complete but temporary relief for a simple abrasion. If symptoms persist after tetracaine, one should rule out more serious eye injury. One also should be aware that small, early corneal ulcers also can present in this way, but are much more serious (*see below*). History of contact lens use, especially overuse (i.e., wearing them for longer than prescribed), should prompt the physician to examine closely for an ulcer. Visual acuity in patients with corneal abrasions often is measured more easily after anesthesia and will be decreased if the abrasion is large or lies in the visual axis. The abrasion usually can be seen with fluorescein dye and cobalt-blue lamp (black light). Visualization is diagnostic and will demonstrate the extent of the abrasion. It also is critical to evaluate the underside of the upper eyelid to determine if a foreign body remains so that further damage can be avoided. Multiple parallel abrasions should alert the physician that the source of abrasion in fact still is embedded in the tarsal conjunctiva of the upper lid.

Most EPs apply antibiotic ointment and patch the eye for comfort. In the past, it was believed that patching would promote more rapid healing of the abrasion, but many studies show no difference in rates of healing between patched and unpatched abrasions.[12] The use of a patch can be left up to the patient if he or she feels it provides any comfort. Injuries from organic material are notable exceptions. They have potential to grow fungal organisms and, therefore, patching of these patients is discouraged. Patients should be instructed not to wear contact lenses until healed, and should have 24-hour follow-up with an ophthalmologist or recheck in the ED. Under no circumstances should a patient be given tetracaine for home use. It will delay healing, masks if further injury is occurring, and can lead to permanent corneal scarring. The cornea has incredible regenerative capabilities, and most defects will have resolved on 24- or 48-hour recheck. Oral pain medications often are necessary to facilitate sleep and tolerance of the wound itself.

Corneal ulcers differ dramatically from abrasions in their management, and actually are a common cause of blindness worldwide. They can occur as a complication of corneal abrasion when the defect becomes infected by bacteria (i.e., Pseudomonas, Streptococcus, or Staphylococcus) or fungi (following use of steroid eye drops). They commonly are seen in patients who wear their contact lenses much longer than prescribed, i.e. leaving lenses in for two months when they should be taken out in two weeks. Ulcers may take up fluorescein like an abrasion, but are different in appearance otherwise. The edges are cloudy white or gray where abrasions are clear looking. A small hypopyon may be present and looks like a hyphema, but with a white color. Emergent ophthalmologic consultation is indicated as treatment consists of frequent topical antibiotics, steroids, and in some cases, admission to the hospital.

Corneal foreign bodies often accompany corneal abrasions. These patients present with many of the same symptoms as those with abrasions: pain, foreign body sensation, injected conjunctiva, tearing, photophobia, etc. Topical anesthetic relieves the symptoms as with abrasion, but on slit lamp or direct visual exam the foreign body can be seen. One needs to be careful to obtain a clear history of preceding events, as any high speed drills, hammering of metal, etc., can be associated with intraocular foreign bodies. (*See section on Orbital Foreign Bodies.*) If irrigation alone does not remove the object, one should use the tip of a tuberculin syringe needle (or 25-gauge needle attached to a 3 cc syringe as a handle) to gently pick the object off the cornea under slit lamp magnification. Obviously, this only should be attempted in a cooperative patient. Cotton tip applicators should not be used to remove corneal foreign bodies as they will rub off a large area of epithelium as well. Metal foreign bodies that contain iron may leave rust rings in the cornea around them. This ring is removed with a hand-held corneal burr, but may best be left to the consultant as the involved cornea will soften over 24-48 hours, making removal easier. While a small amount of burring can be accomplished in the ED, significant drilling or burring in the central line of vision is discouraged. Deeper drilling runs the risk of scarring or, worse yet, perforation of the cornea. The ophthalmologist should be consulted in cases of large or multiple foreign bodies, or for any that are embedded deep enough to make perforation a concern. After simple foreign body removal, treat the patient the same as for a corneal abrasion, as they are left with a similar corneal defect.

Chemical and Thermal Burns. Thermal burns to the globe are relatively rare because reflexes rapidly close the lids and protect the cornea. Hot liquids can splash into the eyes, but usually cause superficial burns only, and are treated like corneal abrasions. Eyelid burns are more common and more prone to complications. Ophthalmology consultation or consultation with a burn specialist is indicated as scar contracture can cause lid retraction. Any significant burn (second- or third-degree) to the eyelids or face in general is an indication for transfer the patient to a burn center. Ultraviolet radiation is a common cause of thermal injury to the cornea, although one initially may not think of this injury as a burn. Welders who take off their protective glasses often end up with superficial keratitis that actually consists of multiple small burns to the cornea. The same problem can arise in skiers and snowboarders who are on the slopes without protective eyewear (snow blindness). Symptoms usually appear about 6-12 hours after exposure to light, and fluorescein dye shows small, sometimes multiple punctuate lesions. These patients can be treated like those with a corneal abrasion.

Chemical burns to the eyes are both relatively common and potentially catastrophic, with blindness a frequent outcome. Chemicals that damage the eye are thought of as acids or bases, with alkali burns being the most severe—a true ocular emergency. Acid burns damage the eye via coagulation necrosis, and the precipitates form a barrier of tissue that stops deeper spread of acid and limits damage somewhat. Alkali substances cause liquefactive necrosis and continue to penetrate and dissolve tissue as long as the substance remains on the eye, thus causing deeper injury. If one is unsure of the pH of the chemical involved, treat as if it is an alkali exposure. Examples of common alkali exposures are cement, plaster, solvents, detergents, drain cleaners, etc. Treatment is continuous and immediate irrigation of the eye, beginning with 2 liters. Irrigation must continue until all of the substance is removed from the eye. Keep checking the pH of liquid in the fornix and irrigate until pH is less than 7.6. Alkali exposures often lead to corneal cloudiness and scleral whitening with subsequent blindness, glaucoma, scarring of the lid, and cataracts. Urgent ophthalmology consultation early in the ED course is advised.

Intraocular/Orbital Foreign Bodies. Large intraocular or orbital foreign bodies typically are obvious and require emergent consult with an ocular surgeon and/or facial surgeon. Any patient diagnosed with an intraocular or orbital foreign body also should be evaluated for the possibility of intracranial injury as well. Smaller foreign bodies can be much more variable in presentation. Care must be taken not to misdiagnose an intraocular foreign body as "just an abrasion." They may have overlapping symptoms, but the history surrounding the event should be helpful. Occult foreign bodies should be considered when a patient presents with history of hammering, grinding, or drilling metal especially in the absence of protective eyewear. Small chips of metal can perforate the globe and leave little or no evidence on physical exam. Patients may present only complaining of eye pain with blurred vision. Plain films can be useful to diagnose radio-opaque objects, but glass, organic matter, etc., will not been seen. CT scan is the most useful test from the ED to evaluate for the presence of a foreign body. Obviously MRI should not be used in cases of possible metallic foreign bodies. Ultrasound recently has been reported as another tool to screen patients for foreign bodies, but it probably is most useful for non-metallic items.[13] Small size and patient cooperation may limit the ability of ultrasound to detect foreign bodies.

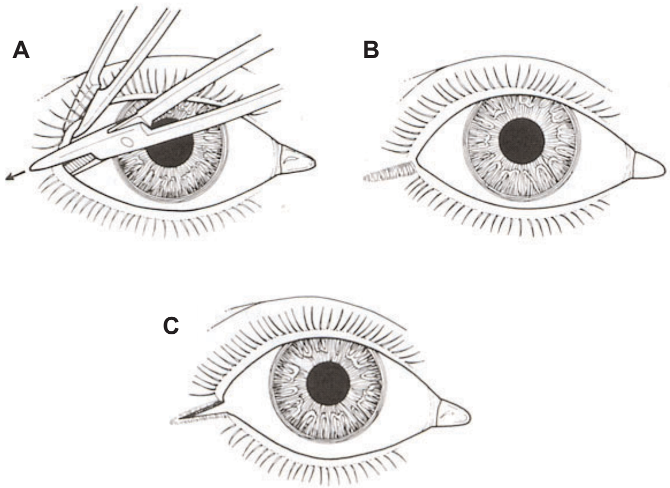
Any intraocular or orbital foreign body diagnosed in the ED should have an ophthalmology consult. Treatment depends on the type of material involved. Particles of iron or copper must be removed to prevent damage to surrounding tissues. Some newer alloys, glass, or porcelain may be left in place. Some foreign bodies are just imbedded in surface tissues and can be removed in the ED. If any question exists on how deeply imbedded the object is, it should be removed by the consultant. Surface objects can be removed with a tuberculin needle and a very steady hand to flick the protruding material from the corneal surface under slit lamp magnification. Careful extraction with the bevel of the needle upward and angled somewhat out from the surface of the eye is very effective, but must be attempted only in very cooperative patients.

Other Globe Trauma. Multiple other conditions can result from orbital/globe trauma, including: subconjunctival hemorrhage, lens dislocation, hyphema, vitreous hemorrhage, retinal detachment, and traumatic iridocyclitis (iritis). Iritis is common following any blunt trauma to the eye and results from spasm of the ciliary body and iris. Patients complain of eye pain, photophobia, and have injected conjunctivae on exam. On slit lamp exam, cells (small debris) and flare (smoky appearance of light passing through the anterior chamber) can be seen. Pain will not be relieved with topical anesthetic and will increase when the patient tries to focus on a near object. Treatment consists of a long-acting cycloplegic (homatropine [Isopto Homatropine]) to relax the ciliary muscle and ophthalmology follow-up.

Retrobulbar Hematoma. A retrobulbar hematoma or orbital hematoma is a true ophthalmological emergency. It can be thought of as an orbital compartment syndrome. After orbital trauma (usually blunt), bleeding develops in the orbit. Problems arise as the orbit, like the skull, has an organ surrounded by bone and accumulation of blood inside this space compresses and damages the contained organ. In the case of a retrobulbar hematoma, accumulating blood compresses the optic nerve and/or central retinal artery and can lead to permanent vision loss in as little as 90 minutes. Vision is lost from central retinal artery occlusion, direct compression of the optic nerve, and/or disruption of the blood supply to the optic nerve. Fortunately, diagnosis usually is not difficult. The patient presents after trauma with sudden proptosis, pain, and vision loss. Be aware that hematomas also can develop as a complication after orbital surgery. The IOP will be elevated, and CT scan, if done, will show the hematoma. As time is vision, emergent ophthalmologic consultation is required. If no consultant is available and transfer must be done to obtain consultation, the ED physician will have to initiate treatment to prevent permanent vision loss. Likewise, if the diagnosis is evident clinically, one should not delay treatment for CT verification. Emergent lateral canthotomy is the treatment of choice. Other temporizing measures include anterior chamber paracentesis and IV mannitol, but lateral canthotomy is more likely to succeed. Lateral canthotomy is an emergent procedure and should not be delayed for arrival of the consultant. Indications for lateral canthotomy are: decreased visual acuity, proptosis, and IOP greater than 40-50 mmHg.

Lateral canthotomy is performed by injecting 2% lidocaine with epinephrine into the lateral canthus (*See Figure 2*). An assistant usually is needed to stabilize the patient's head during the procedure. Next, a small hemostat is used to grab and firmly crush the lateral canthus. Hold it with the hemostat for 1-2 minutes as this will dramatically reduce bleeding after the incision. Next gently take a blunt scissors (iris scissors) and cut the area crushed by the hemostat. Alternatively, one can place two hemostats on the lateral canthus and incise between them. One has to cut the lateral canthal ligament to release pressure from the hematoma. The ligament originates from the orbital rim, and if one has difficulty identifying the ligament, incision down to the bone usually will succeed in severing the ligament. Successful separation of the lateral ligament will be evident by increased proptosis and return of vision. Obviously, care must be used to avoid inadvertently injuring the globe, and this is best achieved by retracting tissue laterally before making incisions. Once performed, the incision is left to heal by secondary intention and generally heals well without significant scarring. Canthotomy is only temporizing, and the patient still will need to go to the OR

Figure 2. Lateral Canthotomy Procedure



First one clamps hemostats over the lateral canthus for 1-2 minutes. This will greatly reduce hemorrhage. Next, the lateral canthal ligament is severed. As this is accomplished, pressure on the globe is relieved and the globe will protrude further. Remember to lift away from the eye when incising the ligament to avoid globe laceration.

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for formal drainage of the hematoma.

Orbital Fractures. The presence of an orbital fracture implies a significant mechanism of trauma, and one always should rule out globe injuries that may require more urgent intervention first. (*See section on Globe Injuries.*) Globe injury is not as rare as one might expect in blunt trauma. Significant globe pathology is diagnosed during ophthalmology follow up in fully 40% of patients who are referred from the ED after blunt trauma.[17] Another 10-year study of 199 orbital floor fractures found a 19% incidence of serious ocular injury, 40% of which were globe ruptures.[18] They also found a 77% incidence of other facial fractures in these patients. Yet another study found a high incidence of orbital fracture and globe injury associated with all-terrain vehicle (ATV) accidents.[19] Thus, blunt trauma patients with orbital fractures are likely to have associated fractures and serious globe pathology.

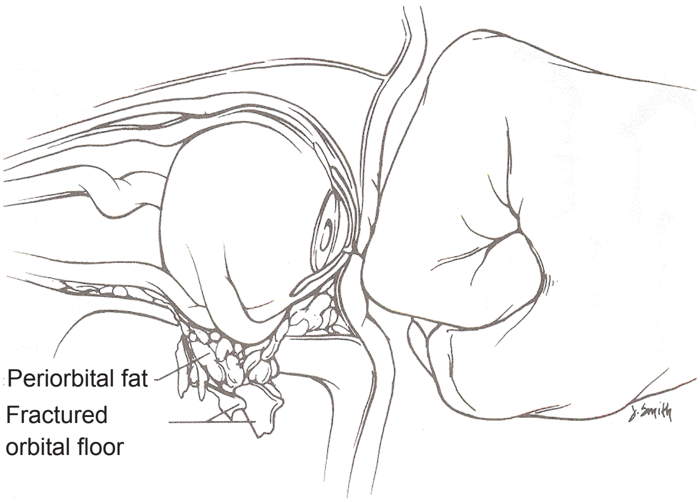
Orbital fractures, or blowout fractures, are classified as pure or impure, with pure fractures involving only the orbital floor and impure fractures extending into the orbital rim as well. One may expect impure fractures to require more force and, therefore, produce a greater incidence of globe injury. At least one study, however, has shown the opposite to be the case. A study of 250 orbital fractures found patients with pure orbital fractures were nearly three times as likely to have concomitant ocular injuries as with impure fractures (5.6% vs 2.0%).[20] These results suggest that perhaps the orbital rim absorbs some of the force and protects the globe in the process. This idea is supported by another study of 410 ED patients with blunt orbital trauma.[17] These authors divided the patients into mild, moderate, and severe in terms of ED evaluation. Mild injuries did not require imaging in the ED, moderate ones had imaging but no fracture, and severe injuries were diagnosed with fractures in the ED. The important feature of the study was that patients without orbital fracture were nearly twice as likely to have globe pathology.[17] Mild and moderate patients actually were at higher risk, 41% and 59% respectively, for globe injury than those with severe injury (29%).[17] These studies show that one should remember patients with a pure orbital fracture are at higher risk for globe injury, and one may not safely assume that globe injury is less likely if no orbital fracture is identified. All patients with any significant orbital trauma, but no diagnosed injury in the ED, should have referral for recheck by an ophthalmologist.

The thin nature of the orbital walls makes them relatively susceptible to fracture under the right conditions. Blunt trauma producing inward pressure on the globe can push it toward the orbital wall(s) and cause a fracture. Some feel the eye itself contacts the wall to produce the fracture, while others suspect a general increase in orbital contents pressure causes the fracture.[21] Based on the biomechanics of the orbit, the object striking the eye must have a radius of curvature less than 5 cm to produce a blowout fracture. (*See Figure 3.*) Any larger and the object will hit the orbital rim before enough pressure can be applied to the globe and cause orbital wall fracture but no blowout fracture. While the fist is of correct size to produce these fractures, falls were the most common cause in one recent study (falls —37%; assaults—27%; and sporting events —27%).[22] Blowout fractures most commonly involve the floor, followed by the medial, lateral, and superior walls. Be aware that blowout fractures extending into the orbital rim also may include maxillary, naso-orbital, and frontal bones. Complete delineation of fractures present can be done only with facial bone CT scan.

Clinical findings with orbital fractures include: diplopia, subcutaneous emphysema, enopthalmos, palpable step-off on the orbital rim, and anesthesia in the infraorbital nerve distribution (V2). When seen, enophthalmos indicates an extensive fracture. In some patients extensive soft-tissue swelling can obscure these clinical findings. One must move the lids out of the way when the eye is swollen shut to assess vision and eye movements. Numbness more commonly is detected on the upper lip with infraorbital nerve involvement. Subcutaneous or intraorbital air indicates a medial wall fracture with direct connection from the sinuses to the orbit. Small amounts of air can be detected better on CT scan, and when found, the patient should be instructed not to blow his or her nose. This can cause air to accumulate in the orbit and can occlude the central retinal artery from increased orbital pressure. Patients will complain of sudden decrease in vision, and emergent ophthalmology consult is indicated. Air must be aspirated or lateral canthotomy performed to reduce pressure and restore blood flow to prevent permanent vision loss.

Diplopia on upward gaze is the most common clinical finding suggesting blowout fracture. Diplopia usually results from entrapment of the fibrous septae that support extraocular muscles rather than entrapment of the muscle itself. While diplopia can

Figure 3. Blowout Fracture



As intraocular pressure is suddenly increased, the thin walls of the orbit give way and orbital contents (fat, extra-ocular muscles) prolapse into the sinus.
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occur in lateral or downward gaze, upward diplopia from inferior wall fracture is by far the most common. In more severe cases, the affected eye's resting position also will be lower than the unaffected eye, yielding diplopia on forward gaze as well. Remember that entrapment is not the only cause of diplopia, and one should consider third cranial nerve injury if no fracture can be identified. Be sure to test for monocular diplopia by ensuring the diplopia is gone when one eye is covered. Monocular diplopia suggests lens dislocation.

Patients with suspected orbital fractures should have facial CT scan to rule out the diagnosis, as plain films are not as sensitive for these fractures. One study demonstrated that plain films were diagnostic in only 8% and suspicious in another 8% of 59 known blowout fractures.[22] In the same study, CT was 100% accurate. One may see fat or soft tissue protruding into the maxillary sinus (hanging teardrop sign), bony fragments, or just fluid (blood) in the maxillary sinus. Fluid in the maxillary sinus with suspicious mechanism means blowout fracture until proven otherwise, and may require consultation to do so.

Outpatient management of orbital fractures is the general rule. The individual case should be discussed with the ophthalmologist on call while the patient is in the ED to ensure the consultant's preferred treatment is followed and to lock in a follow-up appointment. Timing of surgical intervention to free up entrapment is debatable, but most authors now recommend waiting 1-2 weeks before attempting repair. Dangers if operating too early include increased hemorrhage from traumatized tissues and the possibility that diplopia may resolve spontaneously if given time. Operating too late makes repair technically more difficult from increased scarring and bony fusion. Prophylactic antibiotics are not prescribed universally, and the decision should be made in consultation with the ophthalmologist. Given the potential complications and occult globe injuries that may be present, the emergency physician (EP) always should discuss the case with the consultant before sending the patient home, even in the middle of the night. It should be thoroughly explained to the patient that surgery is delayed for a reason, and the importance of following discharge instructions should be stressed.

Nasal Trauma

Wound Repair. Nasal laceration repair is complicated by relatively unforgiving skin. Even 6-0 suture under tension will tear through nasal skin, and minimal skin laxity makes closing gaping wounds challenging. Consequently, debridement of nasal wounds usually is best left to the consultant. Cartilage and bony injuries are common with nasal trauma (*see section on Nasal Trauma: Deep Structure Injury*), but do not always require additional treatment. Skin over non-displaced fractures is closed normally, and cartilage repair seldom is indicated. It is important to examine each patient for septal hematoma, because it can cause pressure necrosis and deformity from collapse of the nasal septum (saddle-nose deformity) if untreated (*see section on Septal Hematoma*). Likewise, any clear fluid from the nose may indicate CSF rhinorrhea and should prompt evaluation for skull (cribriform plate) fractures. Unfortunately, testing for glucose in suspected CSF fluid is not enough to differentiate CSF from other nasal discharge.[23] (S*ee section on CSF Rhinorrhea.*)

Anesthesia is best obtained by gentle injection of small amounts (without epinephrine) through 27- or 30-gauge needles. Nasal blocks are possible but difficult to obtain, and are best referred to the consultant if required for larger injury. Skin can be cleaned with diluted (1%) povidone-iodine but irrigation should be done with plain saline, as fluid easily can spill into the posterior pharynx, mouth, or eye. Gaping wounds can have one or two deep sutures with 5-0 or 6-0 absorbable suture to reduce surface tension. Deep sutures also are helpful to support the healing scar after surface sutures are removed as tape may not always stick. Nostril injuries often affect skin, cartilage, and mucosa, but usually only the skin requires repair. The skin edges must be realigned carefully to avoid a notched appearance afterward. The alar rim suture can be the first suture placed to ensure good re-approximation and, like the vermillion border, can be left untied to ease deep suture placement. Nostril cartilage usually is well approximated with skin closure alone but does require complete skin coverage to avoid chronic chondritis. Thus, mucosal surfaces should be repaired with absorbable suture when needed to cover exposed cartilage. Usually, moving the tissue back into place before repair is initiated will show if mucosal defects are likely to be present after skin repair. Due to their recessed nature, it may be easier technically to place mucosal sutures first during repair.

In general, patients are referred to the consultant when the following are present: wound size that makes closure difficult/impossible, required debridement, any tissue loss/avulsion, displaced fractures, or significant cartilage and/or mucosal injury. After repair, wounds usually can be covered just with a bandage or left open with a thin antibiotic ointment layer. Sutures should be removed in 4-5 days to reduce stitch marks, but unfortunately, nasal skin can be too oily to make secondary support by suture tape effective in many cases. Patients should be made aware of efforts to balance risk of stitch marking and scar widening.

Deep Structure Injury. *Nasal Fracture.* The nose is the most commonly fractured bone in the face, comprising up to 45% of all facial fractures.[24] The nasal bone takes the least amount of force to break (30 grams) compared to other facial bones. That, combined with the exposed location of the nose and the relative lack of soft tissue that can act as a means to dissipate the force of a blow, make the nasal bone prone to fracture. The proximal nasal bones connect with the nasal process of the frontal bone and are much stronger than the more distal part. Thus, about 80% of fractures occur in the lower half of the nasal bones.[25] Altercations, sports injuries, falls, and motor vehicle accidents (MVAs) comprise the most common reasons for fracture. Alcohol abuse in combination with the above increases risk for fracture; thus, one should consider intoxicated patients with facial trauma at higher risk for facial fractures.[24] Though there is no accepted classification scheme, nasal fractures can be thought of as two types: simple fractures and complex fractures. Simple fractures involve only the nasal bones, whereas complex fractures also involve other facial bones (i.e., nasoethmoid or naso-orbital-ethmoid fractures).

Simple nasal fractures are some of the few fractures for which x-rays are not indicated in the ED. These usually are lateral fractures arising from direct trauma. The diagnosis is primarily clinical based on crepitus, pain and tenderness, epistaxis, nasal obstruction, ecchymosis, and deformity. Ultimately, one can have many of these features and not have a fracture, but x-rays will do little to change management in the ED, and routine films are not recommended by Rosen's[23] or current literature.[26] One exception may be suspected nasal fractures with an overlying laceration where antibiotic therapy may be initiated for an open fracture. Most patients accept this and are satisfied with otolaryngologist follow-up in 5-7 days when swelling has subsided. In some cases the physician still may end up ordering nasal films to placate the patient or family.

The first step in treatment is to control any bleeding that may be coming from the nose. Initially this can be done with the use of direct pressure, topical vasoconstrictor sprays, and/or ice. If unsuccessful, anterior packing is the next step. Inability to control bleeding may indicate complex nasal fracture, and otolaryngologist consultation is indicated. Most EPs will not attempt reduction of nasal fracture in the ED as the perception of a deformity is based largely upon the degree of edema that is present around the site of injury. In some cases, the patient may present early enough that swelling has not yet occurred but deformity is obvious. In this case, if experienced with reduction, one may use cocaine- or tetracaine-soaked pledgets for anesthesia and perform closed reduction by exerting a quick firm pressure toward the midline with the thumbs.

Complex fractures involve other bones than just the nasal bones. Ethmoid, lacrimal, and/or orbital bones are the other commonly involved bones, but unfortunately, these more serious injuries are difficult to diagnose clinically. Clinical features of complex fractures that may be hidden by swelling include: widened intercanthal distance (greater than 40 mm is diagnostic), changes in visual acuity, enophthalmos (posterior displacement of the globe from medial rectus entrapment), abnormal glabellar angle, and displacement of the medial canthal ligament causing shift of the eyelid apparatus laterally. Other clinical clues are: CSF rhinorrhea (*see next section*); excessive tearing (indicating tear duct injury); and disrupted olfactory function, which can be difficult to detect in the ED. It is important to realize that suspicion of additional facial fractures is an indication for imaging in the ED. Facial CT is the test of choice with both axial and coronal sections preferred to fully define identified fractures.[23] As many complex nasal fractures are more difficult to repair at more than two weeks, the EP should obtain a consult anytime complex nasal fractures are diagnosed.

When being discharged from the ED, the patient should be given follow-up with the otolaryngologist, plastic surgeon, or oro-maxillofacial surgeon within 4-7 days to allow swelling to resolve. Patients can be instructed that if they have no deformity or problems breathing through their noses once swelling is gone, they may not need further treatment. Adequate analgesics and, in some cases, nasal decongestants also may be given. Prophylactic antibiotics are not indicated for simple nasal fracture, though they should be given for any open fractures. As with atraumatic epistaxis, patients with anterior nasal packing will need to be followed up in either the ED or with the consultant within 48-72 hours for recheck.

Septal Hematoma and CSF Rhinorrhea. The two most important conditions associated with nasal fracture that must not be missed in the ED are CSF rhinorrhea and septal hematoma. CSF leak comes from a dural rent caused by fracture and displacement of the cribriform plate section of the ethmoid bone. Although not a common injury, it is very important to diagnose as a direct connection to the subarachnoid space has been made and the patient is at risk for meningitis and brain abscess. Victims of major trauma may not develop the leak until days later as cerebral edema improves. Definitive identification of CSF fluid is problematic for several reasons. Clear transudate discharge from traumatized nasal mucosa is not unusual. Glucose concentration of both CSF and nasal secretions can be similar. Most EPs must rely on clinical suspicion and placement of a drop of fluid on a piece of filter paper to see if a clear area surrounds the central blood stain.[27] Recently, a new diagnostic test (PhastSystem) has been reported in the literature.[28] Automated electrophoresis can detect a brain-specific protein (tau protein variant of transferrin) that is specific for CSF in fewer than two hours. Initial reports show no false-positives for serum, tears, saliva, or nasal secretion.[28] This technique may prove useful in the near future. Head CT may be helpful if it shows a cribriform plate fracture. Until definitive diagnostic testing becomes widespread, one should obtain urgent neurosurgical consultation whenever suspecting CSF rhinorrhea. The patient should be placed upright (if spines are cleared); intra-nasal packing should be avoided; and the patient should try to avoid coughing, sneezing, nose-blowing, and straining.

Septal hematomas occur with cartilage fractures and result from collection of blood beneath the septal perichondrium. Many patients with septal hematomas are not diagnosed on their first visit. One study of 27 patients found the average delay to treatment was 48 hours.[29] If left untreated, septal hematomas can cause permanent damage via infection and/or necrosis of the septum. Like all cartilage, the septal cartilage is dependent on blood supply from the perichondrium. Elevation of the perichondrium reduces blood supply, and pressure from the hematoma worsens ischemia. Irreversible damage can occur in as little as 72 hours and result in saddle nose deformity, retraction, and voice changes. Alternatively, the septum permanently can be widened and fibrotic, resulting in constant nasal obstruction. Septal hematomas occur more commonly in children, presumably because their softer cartilage predisposes them to more significant injury.

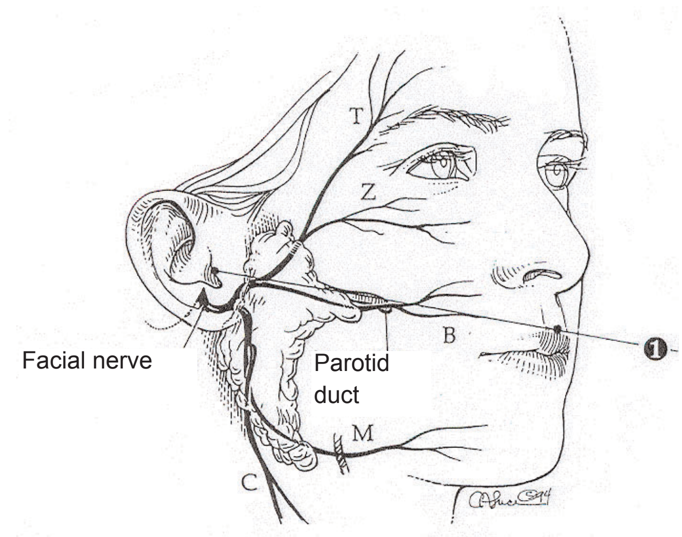
Each nare should be inspected closely for the presence of a septal hematoma. If present, it usually can be seen with an otoscope, appearing as a bluish or purple swelling on the nasal septum. They have been compared to dark grapes in appearance. Large hematomas will occlude the nostril, but smaller, early ones may be harder to see. Take time to look carefully at all of the visible septum. Hematomas can be confused with a deviated septum or swollen turbinates, but aspiration with an 18-gauge needle will be diagnostic. Once identified, hematomas need to be incised, drained, and packed to prevent re-accumulation of the fluid. As septal hematomas are prone to abscess formation, prophylactic antibiotics (cephalexin or amoxicillin/clavulanate [Augmentin]) should be prescribed and a recheck performed in 24-48 hours for possible re-accumulation. As disfigurement from septal hematoma can be severe, it is recommended that consultation with an otolaryngologist be initiated anytime a septal hematoma is diagnosed.

Midface Trauma

Cheek Wound Repair. Wounds to the cheek are relatively common in ED patients and can be caused by blunt as well as penetrating trauma. Simple lacerations in this area can be closed in a similar fashion to other areas of the face (forehead, chin), with 6-0 suture and good approximation. Pay close attention to accurately realign any wrinkles or natural creases first, as with the vermillion border. Improper repair in this regard can be quite noticeable. The mucosal part of through-and-through cheek lacerations can be left open if less than 2 cm, but should be approximated loosely with 5-0 chromic gut if larger. Given the high number of bacterial in saliva (100 million organisms per mL), it may be wise to treat through-and-through wounds with antibiotics prophylactically. Amoxicllin/clavulanate (875/125 mg BID) or doxycyline [Vibramycin] (100 mg BID) for 5-7 days in patients with penicillin allergies are the drugs of choice. Ceftriaxone (Rocephin 1 gram IM or IV) can be given in patients where compliance is questionable.

Before closure, one must remember to evaluate for injury the two very important structures that lie just beneath the subcutaneous fat: the parotid gland/duct and the facial nerve. (*See sections on Parotid Duct Injury and Facial Nerve Injury below.*)

Figure 4. Facial Nerve and Parotid Gland



Note that the parotid duct lies roughly along a line drawn from the tragus to the mid upper lip. It enters the oral cavity along a line from the pupil to the mental nerve. The facial nerve divides into five main branches inside the parotid gland. Any laceration of the parotid gland or duct mandates an exam for facial nerve injury.

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Penetrating or through-and-through injuries are at especially high risk. The first clue to injury of these structures is knowledge of their anatomic location; in other words, one must know the location of which wounds place the patient at higher risk by default. Figure 4 shows the location of the parotid gland, duct, and five branches of the facial nerve in relation to external features. Other clues for parotid injury include saliva leaking from the wound and/or blood seen coming from the duct opening (Stenson's duct) inside the cheek at the level of the upper second molar. The three branches of the trigeminal nerve (supraorbital, infraorbital, and mental nerves) provide sensation to the face, and intact sensation on the face also should be documented. Facial nerve integrity can be established only by testing (and documenting) the function of all five branches. (*See Facial Nerve Injury below.*) In summary, if the patient can lift the forehead/brow, open/shut the eyes, move the lips in a smile or frown, and have contraction of the platysma when shrugging shoulders, the facial nerve is intact. Patients unable to cooperate with testing due to head injury or intoxication are likely to be admitted or observed until their mental status clears, but if discharged from the ED, one must remember to test and document nerve function before discharge. This easily can be overlooked when the patient's stay extends beyond the first physician's shift.

Deep Structure Injury. Although sometimes easy to overlook, any wound in the area between the tragus and the mid-cheek must be examined for injury to the facial nerve and/or parotid gland/duct. Failure to do so in every patient will ensure that, at some point, one will miss an injury and subject the patient to the serious and long-term sequelae. Penetrating trauma is more likely to injure either structure, but blunt trauma also can produce injury. Injuries to either gland/duct or facial nerve from blunt trauma are more likely when fractures of the mandible or zygomatic arch are present.[30] EPs must remember that discovery of an apparent isolated injury to either the facial nerve or the parotid gland/duct mandates evaluation for injury to *both* structures.

Parotid Gland/Duct Injury. The first step in recognizing potential injury to the gland/duct is to be aware of its anatomic location (*See Figure 4*). The duct is about 7 cm long and courses parallel to the jaw. It is found roughly on line from the lower ear to the corner of the mouth. It exits the anterior parotid gland superficial to the masseter muscle before it pierces the buccinator muscle and enters the oral mucosa at Stenson's duct. Although parotid duct injuries only occur in 0.2% of patients with penetrating facial trauma,[31] the consequences of unrecognized injury can be severe. Complications from delayed closure include: infection, fistula formation, sialocele (collection of saliva beneath the skin), and need for duct ligation. Clues to diagnosis start with a high index of suspicion in any laceration between the tragus and the mid-cheek. Remember that one also should consider the diagnosis with fractures of the mandible or zygomatic arch.[30]

The next step is to thoroughly examine any wound on the cheek to see if the duct is visible in the wound. Then one should milk the parotid gland and look for blood at Stenson's duct, located just inside the cheek at the level of the upper second molar. In some cases, to ensure lack of injury, one should cannulate Stenson's duct with a small (19-gauge) silastic tube and look for the tube in the wound. Conversely, a small amount of saline can be injected in the tube to check for flow of saline from the wound. One should not use methylene blue for this as it will discolor facial tissue and make surgical repair even more difficult. If one has no experience with this procedure, or if the patient is not cooperating (i.e., child, intoxicated, etc.) one should consult an oral surgeon or otolaryngologist for help ruling out injury. Parotid gland injuries usually are discovered by direct examination of the wound. The capsule of the gland may be seen in the wound, or saliva may be leaking from the wound. Obviously, small injuries will be much more difficult to detect.

If detected, an injury to the parotid gland usually can be oversewn, but one must remember before repair to evaluate for concurrent facial nerve injury (see below). A drain usually is placed to reduce infection and prevent sialocele formation. Due to the potential risks, the EP should consult a facial trauma specialist instead of repairing the parotid gland. Inadvertent injury to a branch of the facial nerve during repair sometimes can be prevented only by locating branches of the nerve with an electrical stimulator. Duct repair is even more involved and usually is performed under magnification in the OR. The ends of the duct are located and a stent is placed for 2-3 weeks to prevent stenosis of the duct. In some cases, the duct may not be repairable and will need to be re-implanted into the oral cavity. The transverse facial artery and buccal branch of the facial nerve travel adjacent to the duct and often also are injured. Bleeding from the artery easily can obscure the ends of the duct in the wound. As in any location, blind clamping of an artery is not done as nearby, previously intact structures can be damaged severely. Due to the high numbers of bacteria in saliva, wounds involving the parotid duct/gland should be given prophylactic antibiotics: ceftriaxone 1 gram IM/IV in the ED with outpatient amoxicillin/clavulanate or doxycyline (for penicillin allergy) PO.

Facial Nerve Injury. Wounds and even blunt trauma to the cheek area easily can damage a branch of the facial nerve. Facial nerve injuries are particularly devastating as they affect the patient's ability to display emotion and close the eyes. The patient with Bell's palsy is a good example of all the functions of the facial nerve. "The eye constantly weeps; the mouth dribbles; speech and mastication are impaired. Joy, happiness, sorrow, shock, surprise, all the emotions have for their common expression the same blank stare."[32] Any wound or significant blunt trauma in the facial danger zone is automatically higher risk for facial nerve damage. This zone is bordered by a line from the lateral canthus to the corner of the mouth, and from the zygomatic arch down to the angle of the mandible.

Unfortunately, these injuries easily can be missed in the ED. Some patients are suffering from more dangerous injuries and are not in the ED long enough to detect facial nerve injuries. Others may be difficult to evaluate because of mental status changes from head injury or drug abuse. A large number of patients will have only isolated facial injury and will be treated and discharged from the ED. While the EP should tell the consultants when he or she has high suspicion of facial nerve injury in a patient being admitted, it is the patients whom the EP is treating and discharging who are at highest risk for a missed injury. It is in these cases where the EP can have a large impact, good or bad, on the outcome of the patient's facial nerve injury.

The facial nerve consists of five main branches: the temporal, zygomatic, buccal, mandibular, and cervical (*See Figure 4*). Although electrical stimulation may be required in unconscious patients, the awake cooperative patient should have the following areas tested. Lifting the forehead and brow tests function of the temporal branch. Opening and shutting the eyes along with nostril flaring tests the zygomatic branch. Smiling and frowning are functions of the buccal and mandibular branches, while shrugging the shoulders is initiated by the cervical branch through the platysma. Thus, all these motor functions should be documented as intact when caring for a high-risk injury. It is unlikely that one will identify the severed end of a nerve branch, but more likely that evidence of the nerve damage will be detected from lost motor function.

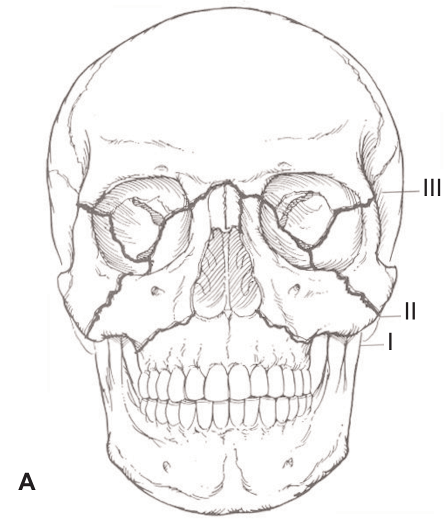
Treatment of facial nerve injury always is referred to the consultant. Treatment options will depend on several factors: time since injury, contamination of wound, other associated injuries (fractures), and location of the nerve injury. The more distal the injury to the facial nerve, the better the chances for spontaneous recovery. At least one study has found that patients with facial nerve defects from extratemporal blunt trauma usually experience complete recovery, while recovery in those with intratemporal damage is unpredictable.[33] Another study suggested use of serial electrophysiological testing to predict the likelihood of spontaneous recovery and timing of surgery.[34] Surgical repair can be attempted by direct anastomosis or nerve grafting, or by newer techniques of single-stage free tissue transfers and bioengineered nerve grafts.[35] No matter which procedure is performed, the results of successful repair do not restore the patient's original function.

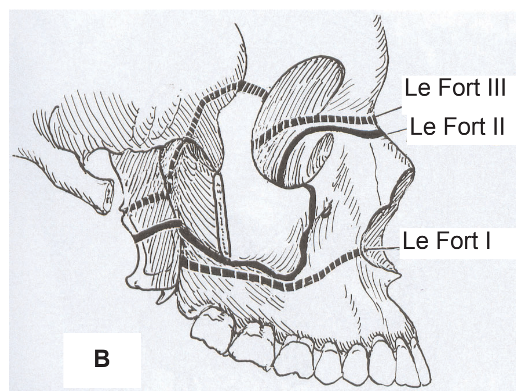
Midface Fractures. *Panfacial Fractures.* Panfacial fractures are facial fractures that simultaneously involve the upper, middle, and lower face. These patients have sustained significant trauma, often via MVAs, and require an approach directed at their truly life-threatening injuries first. (*See previous section on Life-Threatening Injury in Part I.*) Patients with panfacial fractures often will require intubation early in their course of treatment, and at the same time may be difficult to impossible to intubate orally. These patients are much more likely to require cricothyrotomy for airway control than any other facial trauma patient. Be aware also that the natural course of treatment for combined mandible and massive maxillary fractures will require tracheostomy. In some EDs, proceeding directly to tracheostomy in the OR may be the most efficient method of obtaining airway control. EPs should think through the optimal method for management of a patient with panfacial fractures in their EDs before they are faced with the challenge of managing one.

Maxillary or Le Fort Fractures. The maxilla basically comprises the middle third of the face and, with its attachments, functions to support vertical forces generated by mastication. In other words, it acts as a bridge between the skull and the jaws. It also houses large air-filled spaces, the maxillary and ethmoid sinuses. While the maxilla provides good support for vertical forces, the sinuses make it vulnerable to lateral or anterior forces. These are high energy injuries as it takes at least 100 times the force of gravity to produce a Le Fort fracture. Once the buttress system of the maxilla begins to break, it fractures on three reoccurring lines of inherent weakness. These three fracture patterns originally were described the French surgeon Leon-Clement Le Fort in his 1901 cadaver study, and since then maxillary fractures also have been termed Le Fort fractures. One should be aware that while this fracture classification is used and accepted widely, it is rare when a pure fracture pattern occurs. Most midface fractures are mixed combinations, with a type III on the right side and a type II on the left, for example. Further, these are devastating injuries that often are the result of high-speed deceleration. Associated injuries to the head, cervical spine (C-spine), chest, abdomen, etc, are common and should be screened for when Le Fort fractures are diagnosed.

Le Fort I fractures only involve the maxilla at the level of the nasal fossa (*see Figure 5*) and usually result from a downward blow on upper alveolar ridge. It is a transverse fracture that separates the body of the maxilla from the lower portion of the pterygoid plate and nasal septum. When testing midface stability clinically (*see information on physical exam below*), the nose does not move with the midface in contrast to the other Le Fort fractures. As this is the least severe Le Fort fracture, complications such as intubation and CSF leaks occur at lower frequency with type I fractures than with type II or III.

Figure 5A and 5B. Le Fort Fractures





Note that type I fractures involve only the maxilla and type II do not involve the zygomatic arch or orbits. Type III fractures separate the entire facial skeleton from the skull. **Figure 5B** shows a lateral view of the three Le Fort fractures to help illustrate the differences.

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Le Fort II fractures also are called a pyramidal fracture due to their triangular appearance. It is a fracture of the maxilla, nasal bones, and medial aspect of the orbits. (*See Figure 5.*) It is like a Le Fort I fracture whose superior margin is moved upward to include the nose. This pattern usually results from a blow to the lower or mid-maxilla. In contrast to Le Fort I fractures, the nose moves freely with the maxilla, but in contrast to type III fractures, the zygomatic arches and orbits do not. Any midface fracture involving the orbits has increased risk for vision loss. One study of midface fractures found 20-22% of these patients lost vision in one eye,[36] either from traumatic optic nerve injury (more common) or ruptured globe (less common).

Le Fort III fractures also are referred to as craniofacial disjunction, as the entire face no longer is connected to the skull. (*See Figure 5.*) The maxilla, zygoma, nasal bones, ethmoids, vomer, and all lesser bones of the cranial base all are fractured. This injury often results from a blow to the upper maxilla or nasal bridge. When testing midface stability, the entire face can be moved independently of the skull.

A Le Fort IV fracture also has been described since Le Fort's original study, and adds a frontal bone fracture to the type III description.[37] While type IV fractures may not be distinguishable clinically from type III fractures, they usually present as open skull fractures with intracranial air seen on CT scan. One study of 882 patients with facial fractures found only 4.4% had concurrent skull fractures, but of those that did, 70% had midface fractures.[38] In other words, a facial fracture alone is not a very high risk for skull fracture, but midface (Le Fort) fractures are very high risk for associated skull injury.

Physical exam often suggests the presence of Le Fort fractures. While substantial swelling can obscure subtle changes, patients with type II or III injuries can present with a dish-face deformity where the midface has been pushed back and gives a flattened appearance of the face. In the extreme example, the midface may need to be pulled forward to relieve airway obstruction. The most useful maneuver is to test midface stability by grasping the upper alveolar ridge (not the teeth) with one hand while stabilizing the skull with the other. Any movement of the maxilla suggests a Le Fort fracture. In most cases, the abnormal mobility of the midface easily is appreciated. In conscious patients, one also may detect infraorbital and/or facial nerve defects. Even with closed injuries, the parotid duct also may be injured.

When a Le Fort fracture is suspected by mechanism and/or clinical exam, one should image with facial CT scan instead of plain films.[39] Facial CT, especially with coronal sections, will give the ability to make 3-D reconstructions that can greatly aid pre-operative planning. Plain films will not adequately delineate these fractures, and both current literature[39] and text in emergency medicine[40] recommend going directly to CT.

Treatment of patients with Le Fort fractures usually will center first on airway management. Many patients with Le Fort fractures either will be intubated before arrival to the ED or will require intubation soon after their arrival. (*See section on Life-Threatening Injuries in Part I.*) These fractures combined with the massive soft-tissue injury that can accompany them make these patients frequent candidates for surgical airway control. Facial bleeding can be severe, and up to 5% of patients will have life-threatening hemorrhage from facial vessels.[41] Treatment for massive bleeding starts with nasal packing. If unsuccessful, selective embolization is the recommended alternative,[42] and the patient should be transferred if necessary to obtain embolization. Once the patient is stabilized in terms of their other injuries, surgical repair of the fractures is performed with the goals of restoring midface height and correcting malocclusion, mastication, lacrimation, and the senses of smell, taste, and hearing, as well as restoring cosmetic appearance and facial expression.[43] Patients with open skull fractures (Le Fort IV) should be given prophylactic antibiotics even though they have not been shown to prevent meningitis or brain abscess formation.[44] The same study did, however, show early, aggressive surgical repair was more likely to prevent infection.

Zygoma Fractures. Zygoma fractures occur in two major varieties: arch fractures and tripod fractures. Arch fractures are the most common type, while tripod fractures are the more serious injury. The prominence of the zygoma makes it a common site of facial fracture. Most injuries are due to direct blows over the zygoma from assaults, MVAs, and falls. Zygomatic fractures are not low-energy fractures, and in one series nearly 60% of isolated arch fractures were displaced.[45] Isolated arch fractures usually occur near the midpoint or are a double fracture that produces a displaced, large central fragment. This fragment can impinge upon the coronoid process of the mandible, reducing jaw motion. Up to 45% of patients complain of trismus and have limited jaw motion.[46] Isolated arch fractures are best seen with plain films using the submental vertex (bucket handle) view which isolates the arches. CT scanning may be indicated to rule out other associated fractures. Isolated arch fractures do not require admission, but most likely will require surgical repair in the near future. Surgery is indicated to restore malar symmetry and to correct jaw motion.

Tripod fractures are a combination of an infraorbital rim fracture, diastasis of the zygomaticofrontal suture and disruption of the zygomaticotemporal junction of the arch. The bone fragment usually is depressed and pulls the lateral canthus away from the eye, giving the eye a tilted appearance. This rarely is evident in the acute setting and usually is hidden by soft-tissue swelling. Between 50% and 90% of patients may complain of infraorbital and upper lip anesthesia from impingement, and approximately 12% will have diplopia.[47] Although the examiner may not consider zygomatic fracture high risk for diplopia, it can occur from a variety of reasons, including: hematoma, muscle injury, motor nerve injury to the extraocular muscles, and entrapment of extraocular muscles. A smaller percentage (3-4%) will have enophthalmos as well as displacement of the orbital wall that enlarges the orbit.[48] Consultation with a facial trauma surgeon is indicated when a tripod fracture is diagnosed.

Maxillary Sinus Fractures. The walls of the maxillary sinus are not very strong, and isolated maxillary sinus fractures can occur from direct blows to the face. Patients complain of facial pain, but may not have dramatic swelling. Imaging with facial CT or plain films usually will show an air fluid level in the maxillary sinus. In isolation, maxillary sinus fractures do not normally require treatment other than prophylactic antibiotics and outpatient follow-up with an ENT.

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Physician CME Questions

41. Which of the following statements is true of forehead wounds?
    A. They are considered part of the scalp and closed similarly.
    B. Vertical wounds have little risk for scar widening.
    C. Large flaps are low risk for cosmetic complications if re-approximated well in the ED.
    D. None of the above.

42. Which of the following methods should *not* be used to control scalp bleeding?
    A. direct pressure
    B. wound closure
    C. suturing the bleeding vessels
    D. pressure bandage

43. Which of the following is *false* concerning the canalicular system?
    A. Only one canaliculus must remain intact for proper tear drainage.
    B. The duct is unlikely to be torn by blunt trauma.
    C. Easy direct visualization of injuries makes the use of dyes and probes unnecessary.
    D. All of the above

44. Which patients are high risk for an open globe injury?
    A. Patients with penetrating injury around the orbit
    B. Those with high intraocular pressure
    C. Those with normal pupil shape
    D. Cases in which there is a normal view of the optic disc

45. Which of the following is *false* concerning retrobulbar hematomas?
    A. They can lead to permanent vision loss in as few as 90 minutes from onset.
    B. They are best treated by emergent lateral canthotomy.
    C. They are associated with acute proptosis.
    D. They will not need further treatment if lateral canthotomy is performed in the ED.

46. Which of the following concerning blowout fractures is true?
    A. Pure blowout fractures involve only the orbital floor.
    B. Impure blowout fractures extend into the orbital rim.
    C. Monocular diplopia is suggests lens dislocation.
    D. Diplopia on upward gaze is the most common clinical finding suggesting blowout fracture.
    E. All of the above

47. Which of the following statements concerning nasal fractures is true?
    A. Inability to control bleeding may indicate a complex nasal fracture.
    B. Prophylactic antibiotics are not indicated for simple nasal fractures, but should be given for open fractures.
    C. X-rays in the ED are not indicated for simple nasal fractures.
    D. Most EPs will not attempt nasal fracture reduction in the ED.
    E. All of the above

48. CSF rhinorrhea:
    A. can be detected by glucose measurements.
    B. is a complication of simple nasal fractures.
    C. is a complication of cribriform plate fracture.
    D. can be diagnosed easily because CSF is simple to identify definitively in the ED.

49. Which of the following statements about parotid duct injuries is *false*?
    A. They can be injured from blunt trauma.
    B. Blood at Stenson's duct is a sign of injury.
    C. Penetrating trauma is less likely than blunt trauma to injure the parotid duct.
    D. Duct repair usually is performed under magnification in the OR.

50. Which of the following statements is true of Le Fort fractures?
    A. They can be detected on clinical exam.
    B. They require CT scan to delineate them adequately.
    C. Treatment usually centers first on airway management.
    D. All of the above

CME Answer Key

41. D	46. E
42. C	47. E
43. D	48. C
44. A	49. C
45. D	50. D

Emergency Medicine Reports
CME Objectives

To help physicians:

- quickly recognize or increase index of suspicion for specific conditions;
- understand the epidemiology, etiology, pathophysiology, and clinical features of the entity discussed;
- apply state-of-the-art diagnostic and therapeutic techniques (including the implications of pharmaceutical therapy discussed) to patients with the particular medical problems discussed;
- understand the differential diagnosis of the entity discussed;
- understand both likely and rare complications that may occur.

Correction

In the July issue of *Emergency Medicine Specialty Reports* (S04179), the dosage for ketorolac was listed incorrectly on page 4 in the first full paragraph in the left column. The dosage listed exceeds the recommended dosage for adults. The correct recommended dosage in adult patients should be 30 mg total. Furthermore, as previously stated in the text of the article, the dose should be reduced in patients older than 60 years of age, those with known or suspected renal insufficiency, and those with acute or chronic dehydration. We apologize for the error. To print out a corrected version of the article, please visit our web site at www.emronline.com and look for the July issue of EMSR.

Additional Information on Eye Trauma to Supplement "The Facial Trauma Patient. Part II: Orbital and Nasal Trauma"

(Vol. 25, No. 18, Aug. 23, 2004)

Subconjunctival Hemorrhage. Subconjunctival hemorrhage is common as the conjuctival vessels are fragile, and a variety of insults can produce unsightly hemorrhages to a portion or nearly the entirety of the sclera. While trauma can produce these, seemingly innocent changes in intraocular pressure (IOP) also may produce these hemorrhages. Valsalva pressure spikes as result of sneezing, coughing, vomiting, or straining frequently are the cause, as is hypertension itself. They also may develop spontaneously without a discernable cause. Management remains supportive, and no specific treatment is necessary. Most hemorrhages will resolve within 2-3 weeks without sequelae. It generally is agreed upon that recurrent episodes warrant further investigation as to the cause, and coagulation studies may be necessary.[1]

Lens Dislocation. Blunt eye trauma also may disrupt its connecting fibers (lens zonule fibers) and sublux or dislocate the lens. Subluxation occurs with partial tearing of the connecting fibers, whereas dislocation occurs with complete disruption. Patients with Marfan's syndrome may be at risk for dislocation with only minor trauma. Besides pain, the patient will have monocular diplopia and obvious decreased visual acuity. The lens can dislocate posteriorly or anteriorly, and may be seen when the pupil is dilated. Posterior dislocations may not benefit from intervention, but anterior ones acutely may block the flow of aqueous fluid and trigger acute glaucoma. Emergent ophthalmology consult is indicated for any lens dislocation or subluxation.

Hyphema. Blood vessels in the iris or ciliary body can be torn and bleed into the anterior chamber. Blood accumulating in the anterior chamber, is termed a hyphema, as opposed to a collection of pus, which is called a hypopyon. Cells gradually settle in the anterior chamber and clinically one sees a meniscus at the lower edge of the iris when the patient is upright. If the patient is supine, one may see only a darkening or cloudy appearance of the anterior chamber. Hyphemas are graded 0 to 4 in terms of severity. Grade 0 has no layered blood, and grade 4 has filling of the entire anterior chamber with blood. Obviously, patients with abnormal bleeding times (i.e., anticoagulation therapy, hemophilia, etc) will be at higher risk for hyphema development with minor trauma. Symptoms are not specific as patients complain of pain, photophobia, and decreased visual acuity. One must look closely to identify a small hyphema and not miss the diagnosis. Treatment varies on the size of the collected blood. Ophthalmology consult always is needed, but small (grade 0-1) hyphemas may be treated as outpatients with head of bed elevation (45°), analgesics, antiemetics, and limited activity. Higher grade hyphemas or patients with elevated IOP (greater than 25 mmHg) will need admission, and possible surgical drainage of the hyphema. Any large clots present in the anterior chamber will need to be removed surgically. Rebleeding is a feared complication and occurs in 30% of cases within 3-5 days,[1] many of which will require surgical intervention to reduce IOP. Other potential complications include staining of the cornea and blockage of the trabecular meshwork with a resultant increase in IOP.

Vitreous hemorrhage. Vitreous hemorrhage occurs when blunt trauma disrupts blood vessels on the inner surface of the globe. One should look for vitreous hemorrhage whenever a patient complains of floaters or black swirling dots or strands after trauma. This is caused by small clots and blood cells in vitreous space moving in and out of the visual axis. On exam, the red reflex will be absent, and the fundus may appear blurred. In severe cases, the retina will not be visible and one will see only a red haze in the posterior chamber. Initial treatment in the ED consists of ophthalmology consult in the ED, head-of-bed elevation, and maneuvers to keep IOP low (i.e., antiemetics, correcting coagulopathies, etc.). Some patients will require vitrectomy for persistent bleeding.

Retina Detachment. Retina detachment also can follow blunt trauma, and is a relatively common injury. Patients complain of floaters, which result from the associated bleeding, flashing lights, and visual field cuts. The retinal injury itself does not produce pain. Fundoscopic exam may not reveal any abnormality if damage is located peripherally, as most tears are. When visualized on exam, detachments appear as a hazy gray membrane ballooning off the posterior surface of the eye. Visual acuity is affected only when the macula is involved, and some patients complain of a dark curtain being pulled across the visual field. Any patient suspected of having a retinal detachment or tear needs urgent ophthalmology consultation in the ED.

Recently ocular ultrasound has been advocated as a useful screening tool in the ED for diagnosis of retinal detachment, open globe injury, vitreous hemorrhage, and lens dislocation. Some authors report a high degree of accuracy (98%)[2] for these diagnoses, while others report less impressive results. Another recent study of ultrasound diagnosis of vitreous hemorrhage and retinal injury found that ultrasound correctly diagnosed retinal tears in only 50% of patients, and had nearly a 20% false positive rate for retinal detachment.[3] While ultrasound certainly is helpful in evaluating eye trauma, the EP should consult the ophthalmologist for advice in ruling out these injuries.

Traumatic Iritis. Traumatic iritis (iridocyclitis) may occur as a result of blunt trauma to the globe. The contusion to the iris and ciliary body results in ciliary spasm, which can be quite painful. Patients frequently will complain of photophobia, and will have increased pain on pupillary testing. Concentual photophobia is reported almost universally upon examination. Patients actually may develop symptoms several days after initial injury. Examination reveals perilimbal conjunctival injection; this helps to distinguish this injection from that of a viral or allergic conjunctivitis, which usually spares the limbus. Slit-lamp examination often reveals cells and flare in the anterior chamber, seen as particulate matter that scatters light in the anterior chamber. A small pupil that dilates poorly in darkness is consistent with the diagnosis. Treatment consists of analgesics and a cycloplegic such as homatropine, which may be used for several days to paralyze the iris/ciliary body to relieve spasm. Close ophthalmologic follow-up also is recommended.

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Emergency Medicine Reports

The Practical Journal for Emergency Physicians

Facial Trauma, Part II

Key Forehead Sutures

As with closure of the vermillion border, there are key cosmetic sutures to place on the forehead. The hairline and the eyebrow margins must be re-approximated first, as well as major forehead wrinkles, to minimize the effect of scars on appearance.
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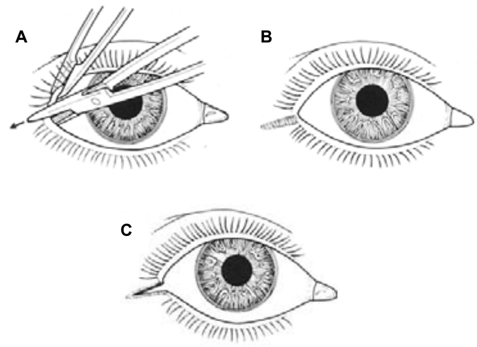
Lateral Canthotomy Procedure



First one clamps hemostats over the lateral canthus for 1-2 minutes. This will greatly reduce hemorrhage. Next, the lateral canthal ligament is severed. As this is accomplished, pressure on the globe is relieved and the globe will protrude further. Remember to lift away from the eye when incising the ligament to avoid globe laceration.
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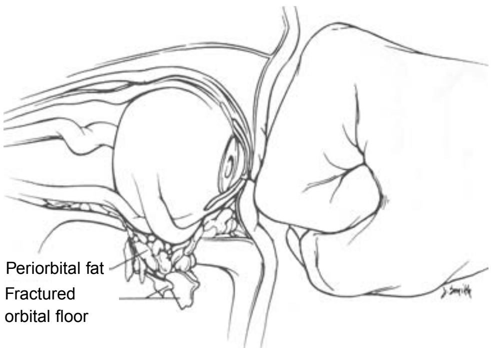
Blowout Fracture



As intraocular pressure is suddenly increased, the thin walls of the orbit give way and orbital contents (fat, extra-ocular muscles) prolapse into the sinus.
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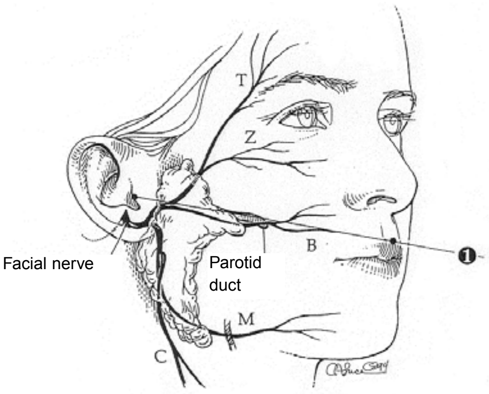
Facial Nerve and Parotid Gland



Note that the parotid duct lies roughly along a line drawn from the tragus to the mid upper lip. It enters the oral cavity along a line from the pupil to the mental nerve. The facial nerve divides into five main branches inside the parotid gland. Any laceration of the parotid gland or duct mandates an exam for facial nerve injury.
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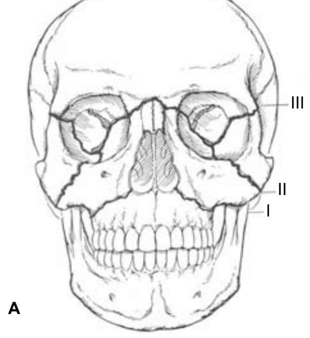
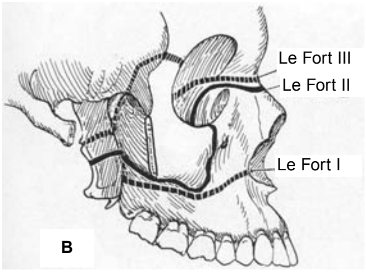
Le Fort Fractures





Note that type I fractures involve only the maxilla and type II do not involve the zygomatic arch or orbits. Type III fractures separate the entire facial skeleton from the skull. **Figure B** shows a lateral view of the three Le Fort fractures to help illustrate the differences.
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Supplement to *Emergency Medicine Reports*, August 23, 2004: "The Facial Trauma Patient in the Emergency Department: Review of Diagnosis and Management. Part II: Orbital and Nasal Trauma." *Authors:* **Gary D. Hals, MD, PhD**, Attending Physician, Department of Emergency Medicine, Palmetto Richland Memorial Hospital, Columbia, SC; **Brandi McClain-Carter, MD**, Resident Physician, Department of Emergency Medicine, Palmetto Richland Memorial Hospital, Columbia, SC; and **Brent Mullis, MD**, Chief Resident, Department of Emrergency Medicine, Palmetto Richland Memorial Hospital, Columbia, SC.