

## SHORT ABSTRACT

# Emergency Imaging in the Head and Neck

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### Abstract

Since the head and neck region is a crossroad of densely packed anatomical structures, every condition causing harm to this region may be potentially life-threatening. These conditions may be due to injury, inflammation and infection. Computed tomography (CT) is considered the first-choice imaging technique in the emergent setting, as a result of its speed, large field of view, high spatial resolution and superiority in bone imaging. Of course, we must be aware of the radiation exposure, but we should also find a balance between the (semi-)recently introduced dose limitation protocols and the potential loss of diagnostic information. Whether iodinated contrast is to be used depends on the type of aggressor: as a rule, in the setting of traumatic injury to the face a non-contrast CT is sufficient to diagnose the extent of the fractures, whereas iodine contrast helps the radiologist when dealing with inflammatory and infectious conditions. Magnetic resonance (MR) imaging provides superior soft tissue delineation but is less attractive as a first-choice imaging technique in the emergent setting, mainly due to the higher acquisition time and consequently higher motion artifacts. Furthermore, (unknown) metallic foreign bodies may cause susceptibility artifacts when they are positioned in the field of view or even cause harm to the patient when entering the high magnetic field. The choice of the correct imaging technique depends on the clinical question. Subdividing the head and neck region into anatomical interconnected areas makes it helpful in understanding the pathology harming each or multiple areas.

### Emergencies of the temporal bone and skull base

The temporal bone (TB) is important as it harbours different structures needed for hearing (ossicles, cochlea), balance (semicircular canals) and facial expression (facial nerve). It is also in close relation to the internal carotid canal, sigmoid sinus, Meckel's cave and cerebellopontine angle. Each of these structures may be at risk in case of trauma or infection. Longitudinal fractures are the most common TB fractures due to a temporoparietal impact and run parallel to the longitudinal axis of the TB. Patients suffering from this type of fracture typically present with hearing loss, otorrhagia. Due to the direction of the force

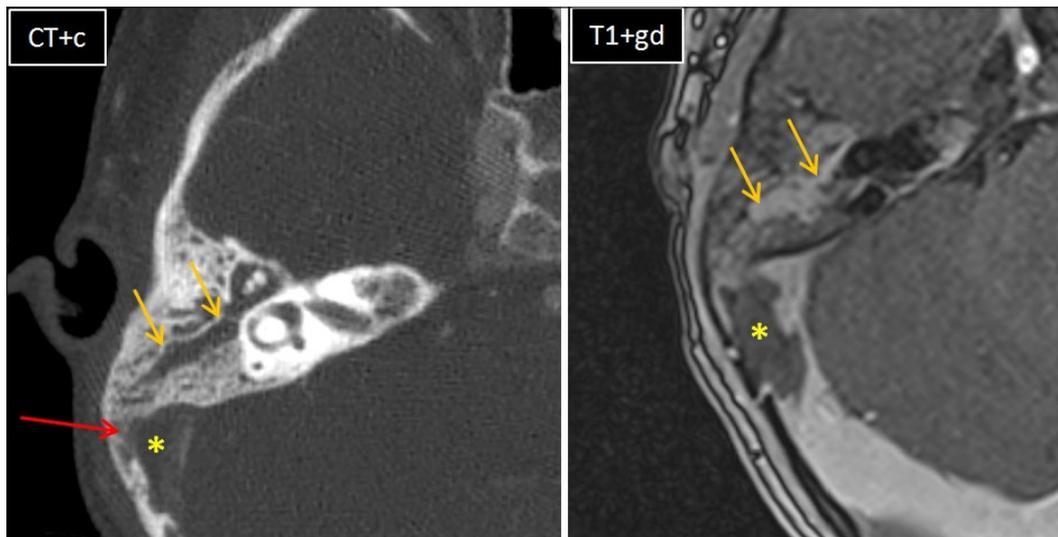
vector, facial nerve lesion is less frequent but disruption of the ossicular chain must be excluded. Conversely, a transverse TB fracture puts the facial nerve and inner ear capsule at risk. Other conditions that may involve the TB are coalescent mastoiditis (see **Figure 1**), labyrinthitis, petrous apicitis and necrotizing otitis externa.

### Emergencies of the maxillofacial region, mandible and orbit

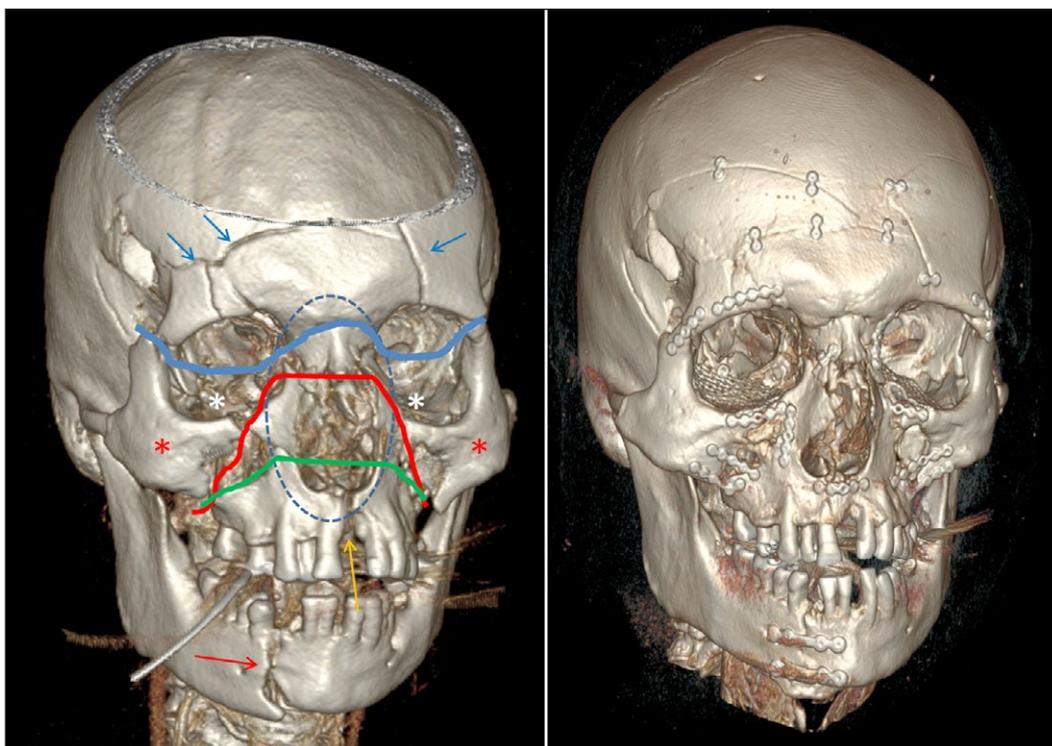
The role of CT in trauma to the maxillofacial structures seems obvious and helps the radiologist in identifying all different fractures, potentially categorizing them according to a certain (or multiple) fracture pattern(s). The use of four horizontal and four vertical osseous buttresses, representing the osseous facial framework, may help in this categorization and understanding of the acuity of several fractures. Also, potential soft tissue injuries as well as acute and late complications may be identified. The signature of Le Fort fractures is the complete fracture of the pterygoid plates, which may result in a partial or complete craniomaxillary dissociation. Naso-orbitoethmoid (NOE) complex fractures, caused by a high-impact force applied anteriorly to the nose and transmitted posteriorly through the ethmoid bone, are classified according to the degree of injury to the medial canthal tendon attachment. Zygomaticomaxillary complex (ZMC) fractures, caused by a direct traumatic blow to the cheek, may result in enophthalmos and facial asymmetry. Orbital blowout fractures may result in extraocular muscle herniation or even muscle entrapment with subsequent restriction of the ocular movements. When a fracture runs through the posterior frontal or sphenoid sinus wall, the patient is at risk for CSF leakage and intracranial hemorrhage or infection. Fractures involving the mandible are mainly categorized according to their location. The mandible is often fractured in more than one location, due to its ring-like configuration and may therefore be highly unstable. Obviously, fractures running through the mandibular canal may injure the inferior alveolar nerve. **Figure 2** shows a complex midface "crush" fracture due to high-impact trauma (motor vehicle trauma) with multiple fracture patterns.

### Emergencies of the sinonasal region

Inflammatory sinus disease reflects a common entity which usually does not require urgent imaging. However, when disease reaches beyond the borders of the paranasal



**Figure 1:** Acute coalescent mastoiditis in a six-year-old boy. CT with IV iodinated contrast shows complete opacification of the mastoid air cells (orange arrows) with erosion of the sigmoid plate (red arrow), complicated by a venous thrombosis of the sigmoid sinus (asterisk – confirmed on MRI T1 fs with gadolinium).



**Figure 2:** Complex midface (facial “crush”) and mandibular parasymphiseal fracture in a 50-year-old male after motor vehicle accident. Left image (3D rendering CT) shows an overview of most fractures. The right image shows postoperative status of these fractures. Blue arrow: frontal bone and sinus fractures. Blue dotted ring: NOE fracture. White asterisk: bilateral blowout fractures with fragmentation of the orbital floor. Red asterisk: bilateral ZMC fracture. Yellow arrow: left hard palate fracture. Red arrow: right parasymphiseal fracture. Green line: Bilateral Le Fort I fracture. Red line: Bilateral Le Fort II fracture. Blue line: Bilateral Le Fort III fracture. Also note the impaction fracture of the right frontotemporal skull.

sinuses – commonly in the setting of immunocompromised or diabetic patients – an acute bacterial sinusitis (ABS) or acute invasive fungal rhinosinusitis (AIFR) may become life-threatening. Subperiosteal abscesses may be secondary to ABS and require antibiotics or surgical drainage. When

ABS is centered in the frontal or sphenoidal sinuses, extension through the posterior wall may cause epidural or subdural empyema, meningitis, cavernous sinus thrombosis (sphenoid origin) or even cerebritis +/- brain abscess formation. AIFR represents the most aggressive type of fungal



**Figure 3:** Late postoperative onset of epistaxis in a 41-year-old female who underwent a LeFort 1 osteotomy for transpalatal distraction (TPD). CT angiography shows a pseudoaneurysm (red arrow) – originating from the distal maxillary artery (orange arrows) – eroding through the right posterior maxillary sinus wall and filling up the entire right maxillary sinus.

rhinosinusitis, almost exclusively seen in immunocompromised patients and in less aggressive form in diabetic patients, resulting in a very high mortality rate. It is characterized by a rapid and aggressive invasion through the sinus walls by angio-invasive spread along blood vessels, typically leaving the bone intact. Progression of this disease to the orbit or brain can occur within 24 hours after onset, with subsequent emergent complications. Recognition of this pathology is important as an urgent debridement and high-dose intravenous antifungal medication are needed to control the disease. Another emergent entity is a fulminant epistaxis, usually not imaged, but may sometimes reveal unusual findings (see **Figure 3**).

### Emergencies of the neck

Due to the important anatomical structures running in the neck, an emergency in this area can be a life-threatening condition, a severe painful situation or a condition in which function is lost. A common painful reason for a visit to the emergency room is an acute sialadenitis in the parotid or submandibular gland. Usually this is second-

ary to an obstructing sialolith, which can be easily identified on CT. A tonsillitis is another common painful entity which can present with a tonsillar or peritonsillar abscess. In case of a peritonsillar abscess, extension to other spaces (floor of the mouth, retropharyngeal) may occur and may even spread to the mediastinum. The radiologist should not only check for the airway status in infectious disease of the neck, but also look for vascular complications: Lemierre syndrome can be seen secondary to pharyngeal infection and is defined by an occluded internal jugular vein. The retrostyloid parapharyngeal spaces (a.k.a. carotid spaces) contain the carotid arteries which can be injured in penetrating trauma. In diabetic or immune-compromised patients, pharyngitis or odontogenic infection may spread diffusely (cellulitis, fasciitis, myositis) and cause multispacial fluid collections with gas collections: necrotizing fasciitis. This entity is highly emergent and requires fast surgical debridement.

### Competing Interests

The author has no competing interests to declare.

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