Editorial

Skull Base Trauma: CommentaryPaul J. Donald¹ Arthur B. Dublin²¹ Department of Otolaryngology–Head and Neck Surgery, University of California Davis Medical Center, Sacramento, California, United States² Department of Radiology, University of California Davis Medical Center, Sacramento, California, United States

J Neurol Surg B 2016;77:379–380.

In this era of high-speed motor vehicle travel and worldwide violence, both domestic and military, the importance of craniomaxillofacial trauma has become increasingly important. This issue of the journal is devoted to this topic from both the radiological and surgical perspectives. This commentary is designed to highlight the major points in these articles.

The miraculous advances in diagnostic and interventional radiology have greatly advanced our ability to appreciate the extent and precise location of these injuries better, thereby enhancing the potential for the employment of the most efficacious method of treatment. A more precise reconstruction of the facial skeleton has been enabled by fine section computed tomography (CT) scanning and the use of 3D tomography. Postprocessing of data from CT, or even an “O-arm,” can be undertaken even in the battlefield situation. The advent of interventional neuroradiology, especially for the control of intracranial and facial hemorrhage, has revolutionized the approach to these problems, reducing the need for extensive surgical procedures that were needed in the past.

An unfortunate sequelae of craniomaxillary trauma is often the creation of a cerebrospinal fluid (CSF) leak. The diagnosis is sometimes difficult because the drainage may be intermittent. The best test currently employed for the detection of a CSF leak is the detection of $\beta 2$ transferrin in the sample of nasal fluid under suspicion. The major drawback is that the sample needs to be sent out to a center that does the test, thus prolonging the time to diagnosis. The old-fashioned “halo test” is helpful if a mix of blood and CSF are emanating from the nose. If a drop of fluid caught on a towel around the blood clot that is twice the diameter of the clot suggests a positive result.

Once the diagnosis of a CSF leak has been established, imaging of such leaks is best undertaken by noncontrast, thin section, submillimetric, high-resolution axial, and reconstructed coronal CT images. Such noncontrast imaging is sufficient in most cases for anatomical localization of skull

base defects. However, for further investigation, especially if multiple CT defects are discovered, or the site of the leak is unclear, intrathecal contrast CT or gadolinium magnetic resonance imaging should be undertaken with thin section coronal T1 and T2 techniques. It is paramount that such studies be acquired on an urgent basis. The technician and radiologist must be prepared to undertake these procedures at a moment's notice. These imaging techniques are less successful in pinpointing a CSF leak if the patient does not have signs of active rhinorrhea, which can be intermittent.

One of the more significant advances in the management of CSF leaks is endoscopic sinus surgery. The transnasal direct view of dural tears from fractures in the roof of the ethmoid and sphenoid sinuses has enabled the placement of dural grafts to close these leaks under direct visualization. The use of angled lenses and newer innovations in instrumentation has facilitated increased numbers of successful repair. With a 70-degree lens, even a dural leak from the lateral extremity of the sphenoid sinus when its pneumatization extends into the lesser sphenoid wing can be seen. A graft can then be placed using similar-angled instruments.

Management of frontal sinus fractures is taken from a therapeutic algorithm used by the first author of this commentary for over 40 years. Some modifications have been made later because of the advent of functional endoscopic surgery. But the goals are the same: esthetic restoration of the forehead contour while at the same time establishing a safe sinus, avoiding infection, and the later formation of a mucocele. This is especially true in the most catastrophic fractures, the so-called “through and through” fracture, where the injuring force penetrates the skin, fractures both anterior and posterior walls, rips the dura, and contuses the brain. Once hemostasis is ensured and necrotic brain removed, the dura is repaired ensuring a watertight seal, and then attention is directed to the frontal sinus. The anterior wall bony fragments are cleansed, then soaked in an antiseptic solution

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Stuttgart · New York

DOI <http://dx.doi.org/10.1055/s-0036-1583542>.
ISSN 2193-6331.

such as Betadine (Purdue Products LP, Stamford, Connecticut, United States). The posterior sinus wall is completely removed, all sinus mucosa is removed by drilling the inner table of the anterior wall remnants and the sinus floor, and then the frontonasal duct is obliterated with temporalis muscle and the anterior wall restored. With time the brain will expand into the defect. The cooperation of the neurological surgeon and the head and neck surgeon is paramount for a successful outcome.

Fractures of the temporal bone are relatively uncommon. The older classification from temporal bone CT divided such injuries into horizontal, transverse, and apical in relationship to the long axis of the temporal bone. These fractures tend to be complex, encompassing all of these complex injuries. Consequently, the classification has been changed to "extra-otic" and "transotic" in reference to the otic capsule. The extraotic type tends to have an accompanying conductive hearing loss, while the transotic injury is associated with a sensorineural loss. In the case of a facial paralysis, decompression of the injury remains controversial. Basically, when the nerve is stimuable, the administration of steroids, rather than immediate surgical intervention, is recommended. If there is no response to electrical stimulation, exploration and possible decompression of the nerve is advised. The authors have clearly outlined the specifics of the electroneuronography test regarding indications and timing of decompression and prognosis. The management of brain injury and CSF leak are also described.

The management of battlefield injuries to the craniofacial skeleton is described by Stevens and Brennan. They have a wide experience of these devastating injuries as front line surgeons in the Middle Eastern conflicts. Due to

the advent of body armor, the incidence of fatal injuries to the chest and torso has been reduced, but the incidence of injuries to the cranium, maxillofacial skeleton, and neck are still commonly seen. The authors contrast the problems of these injuries in the civilian community with the devastating trauma that results from improvised explosive device explosions, rocket-propelled grenades, and the high-velocity weapons encountered in wartime. The formula for the degree of injury caused by handguns and low-velocity rifles so commonly encountered in civilian life contrast markedly with the injuries of armed conflict. Civilian weapons emit small bullets at a low velocity and may not exit the body. The resulting entrance and exit wounds are far smaller than those caused by larger projectiles fired at high velocity in war. The wounding velocity of the latter weapons is entirely absorbed by the target with a considerable amount of secondary wounds from disintegrating contents of the missiles, as well as shattered bone and teeth. The system of triage is well described, as is the management of mass casualty situations, which can be applied to civilian catastrophes. In the management of the maxillofacial wound, the dictum of "less is more" is well exemplified when it comes to early reconstruction where "control of the wound" trumps aggressive reconstructive efforts. Staged reconstruction is far more efficacious.

Finally, we would like to thank the authors of these presentations for their time and effort spent in preparing their articles for this issue. We are particularly grateful for the skill, time, and service that Drs. Stevens and Brennan have given to our military men and women, the latter of whom have given their bodies, and in some cases, their lives in defense of the United States and their Allies.