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Imaging of Head Trauma––Neuroimaging Clinics of North America

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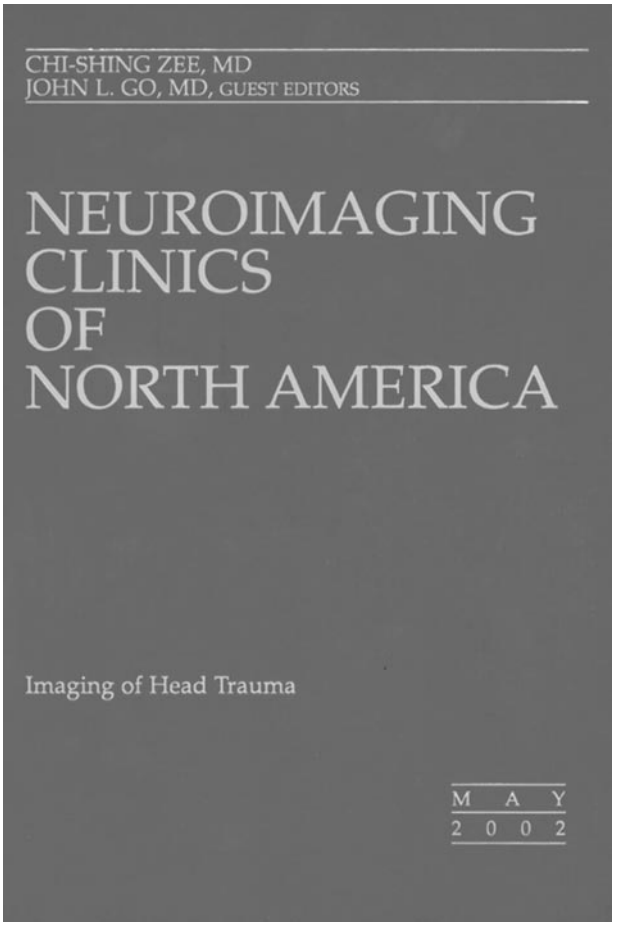
Imaging of Head Trauma—Neuroimaging Clinics of North America
Chi-Shing Zee and John L. Go, guest editors. Philadelphia: W. B. Saunders; 2002. 349 pages, 123 illustrations. $75.00.



Head trauma is a very common entity in both urban and rural settings, secondary to multiple causes. Blunt and penetrating injuries are encountered regularly in any hospital-based practice. General radiologists in private practice and neuroradiologists in all settings need a clear understanding of the anatomy and pathophysiology involved in evaluating these patients. The imaging of head trauma has evolved along with the advances experienced in diagnostic imaging as a whole, and currently there are many excellent publications covering this subject. Like many areas in medicine and radiology in particular, however, this is a dynamic topic necessitating regular and continuing education and reevaluation. *Imaging of Head Trauma—Neuroimaging Clinics of North America,* edited by Drs. Chi-Shing Zee and John L. Go, addresses the clinical, pathologic, and neurosurgical aspects of head trauma as well as imaging and endovascular treatment techniques.

The neurologic assessment of patients with head trauma is reviewed. The initial evaluation of these patients is covered in a pertinent and succinct fashion and emphasis is placed on the importance of this information in overall patient evaluation as well as correlation of the neurologic findings during image interpretation. Basic laboratory studies, ancillary diagnostic testing such as electroencephalography and somatosensory-evoked potentials, the pathophysiology of head trauma, the Glasgow coma scale (GCS), and brain death are reviewed. Standard medical therapy, as well as more controversial treatment options, along with chronic symptoms and sequelae of head trauma, including headache, seizures, and cognitive and behavioral changes, are discussed. The pathology of traumatic brain injury and the antecedent mechanisms of injury emphasizes the combination of forces involved in most injuries.

There is a good comparison of imaging techniques (CT versus MR), along with illustration of the advantages and disadvantages of the two modalities and the evolution of hemorrhage, edema, and mass effect. Excellent CT and MR images demonstrating examples of cerebral contusion, intraparenchymal hematoma, diffuse axonal injury (DAI), subdural hematoma, epidural hematoma, and subarachnoid hemorrhage are included. With accompanying histology, one gains an appreciation of DAI from the imaging, gross pathology, and microscopic perspectives.

Unfortunately, some of the MR images are too small for adequate visualization of findings. The attributes of various pulse sequences in delineating DAI-related lesions are also compared and contrasted. More advanced techniques such as magnetization transfer imaging, MR spectroscopy, and quantitative MR imaging are also included as well as functional MR imaging, single-photon emission CT (SPECT), and positron-emission tomography (PET).

The authors cover gunshot wounds and the roles of conventional radiography, CT, MR, and angiography (conventional, CTA, and MRA) in their assessment. The progression of findings along the projectile path from scalp through skull and brain parenchyma is eloquently reviewed, and the delayed complications are described. The authors emphasize that the presenting neurologic status (GCS) is ultimately the single best predictor of clinical outcome but imaging findings may have prognostic significance when GCS is relatively high. The authors conclude that CT remains the initial imaging technique of choice for assessment of these injuries, with MR proving more significant in the subacute setting.

The spectrum of extracranial and intracranial vascular injuries following blunt and penetrating trauma is covered as well as their management. It is pointed out that traumatic injury to the arteries of the face

and neck is relatively underdiagnosed because of the frequency of intracranial injuries. The frequent absence of external signs of neck trauma following blunt injury to the extracranial portions of the carotid and vertebral arteries emphasizes the need for an aggressive diagnostic approach to identify lesions in the asymptomatic or obtunded patient, with a stress on conventional angiography, CTA, MRA, and sonography. Treatment options are discussed pertaining to the different vascular lesions and range from conservative (medical) management to percutaneous endovascular and conventional surgical techniques. Endovascular treatment options for eradication of dissection, pseudoaneurysm, and arteriovenous fistula include embolization techniques and stent placement and use of these techniques in different situations including. Carotid cavernous fistulas, both direct and indirect, are addressed. Excellent pre- and posttreatment angiographic images are used throughout this section.

Head trauma in the pediatric population is part of this review, and the difference between adult and pediatric head trauma is noted. Injuries associated with birth trauma, including scalp, skull, and intracranial lesions; skull fracture characteristics exclusive to the pediatric age group, including the more common associated findings and delayed complications such as leptomeningeal cyst (growing fracture), diffuse cerebral edema, and hydrocephalus; and several disorders that may mimic child abuse make up this section of the book.

The section on imaging of facial trauma briefly addresses normal anatomy and the components of the facial buttresses. CT is recognized as the imaging technique of choice, delineating the presence and extent of facial bone fractures. A classification of facial fractures is offered and subdivided into limited (simple and complex), transfacial (Le Fort fractures), and smash fractures (naso-orbitoethmoidal). The importance of accurate depiction and description of facial fractures is stressed in facilitating successful surgical treatment and overall outcome. The authors provide a succinct review of orbital anatomy as it applies to imaging of orbital trauma. Imaging strategies are addressed, including the roles of conventional radiography, CT, and MR, with excellent representative images. Mechanisms of injury include the competing theories of blow-out fracture (hydraulic versus buckling). In addition, intraocular injury, optic nerve injury, and orbital hemorrhage, as well as penetrating injury and foreign bodies, are discussed.

Imaging of sequelae of head trauma is an area of neuroimaging that is evolving and progressing with the advent of newer techniques, including functional MR, volumetric measurement, magnetization transfer, MR spectroscopy, diffusion/perfusion imaging, PET, and SPECT. These advanced techniques are alluded to and suggest the growing role of the neuroradiologist in outcomes research and prognostication. These modalities make it possible to detect biochemical and molecular changes before gross anatomical changes are seen in the brain. Sequelae of head trauma are divided into early- and late-onset lesions. Early-onset sequelae include delayed intracranial hemorrhage, pneumocephalus, and CSF leak. Late-onset sequelae include cerebral, cerebellar and corpus collosal atrophy, cerebral infarction, leptomeningeal cyst, and posttraumatic hypopituitarism. The association between head injury (both minor and severe) and disseminated intravascular coagulopathy and fibrinolysis (DICF) is discussed as well as the implication of DICF as a cause of delayed and recurrent intracranial hemorrhage. Examples of the various sequelae of head trauma are illustrated with CT and MR images.

A brief overview of the neurosurgical perspective and surgical management of head trauma is provided. Imaging studies (particularly CT in the acute setting) provide essential information used to guide resuscitation, selection of patients for intracranial pressure (ICP) monitoring, and evacuation of hematomas. Suggested shortcomings of neuroimaging in head trauma are the inability to predict elevated ICP (particularly in the absence of cardinal signs such obliteration of cisterns, midline shift, and mass effect) and the inadequate portrayal of the dynamic growth of intracranial hematomas. It is stressed that imaging findings must be assessed in the context of history and physical examination findings as well as laboratory and monitored parameters. Parenchymal hematoma size and location are considered when contemplating surgical evacuation, because certain locations are less able to accommodate the additional volume of hemorrhage.

This book succeeds in providing the reader with a timely update on the subject of imaging of head trauma and addresses many of the practical concerns of those involved in interpreting these studies. It should be of interest certainly to neuroradiologists as well as other imaging and clinical specialists involved in assessing and treating these patients in the acute care setting. Comprehensive and current references are provided to facilitate more in-depth coverage of specific topics.