Neuroimaging in Comatous Emergencies

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The coma patient who is unconsciousness and unresponsiveness is not an uncommon diagnostic challenge in the Emergency Room. Common diseases that might be responsible for a comatose patient range from trauma, cerebrovascular disease, toxic and metabolic causes. The clinical assessment and investigations for patients with encephalopathy and coma may include brain imaging, but MRI is typically performed in the acute stage only after stabilization and often after initial CT (which may be non-specific in appearance). Important diseases that need to be ruled out include endocrine, infectious, and drug induced causes, including both iatrogenic as well as overdose or the effects of illegal street drugs.

Decreased consciousness can result from brain herniation and compression of the brainstem from a variety of etiologies ranging from the obvious (traumatic brain injury) to the occult (undiagnosed neoplasm). Focal primary brain injury that affects the reticular activating system may also be responsible, typically hemorrhagic or ischemic brainstem strokes.

Disorders of consciousness and altered mental status may predate coma, and in these patients with encephalopathy, MRI may reveal characteristic findings, including focal lesions or diffuse bilaterally symmetrical involvement of gray matter or white matter structures, such the basal ganglia and cortex. A systematic approach to this uncommon group of conditions is often challenging. Hypoxic ischemic encephalopathy and hypoglycemia typically involves the gray matter diffusely, but there are also distinct patterns of widespread white matter diffusion abnormalities in both hypoglycemia and delayed leukoencephalopathy in hypoxia. White matter preponderance may be seen in diseases such as toxic leukoencephalopathy and posterior reversible encephalopathic syndrome (PRES). Alcohol-related disorders of consciousness that may show distinct MRI patterns include Wernicke’s encephalopathy, chronic basal ganglia changes, osmotic myelinolysis and Marchiafava Bignami disease.

Recent advances in MR technology have resulted in new techniques of neuroimaging being applied to research and clinical diagnostic imaging. In acute metabolic disease, diffusion-weighted MR imaging (DWI) and MR spectroscopy (MRS) may be helpful. The extent and severity of brain damage as detected on MRI may also be clinically useful for prognosis. Although functional imaging (fMRI) of awareness in patients in long-term coma and vegetative states is a fascinating topic currently under investigation, this topic will not be addressed in the discussion. This presentation will focus on some common causes of emergency. Clinical examples, mimics and pitfalls will be highlighted. Some uncommon causes such as inherited mitochondrial and urea cycle abnormalities will also be covered.