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Preface: Updates in Brain Imaging

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Shira E. Slasky and Jacqueline A. Bello

Imaging of Acute Stroke: Current State

1083

Steven Hetts and Rajkamal Khangura

This article reviews the current state of imaging for acute ischemic stroke. Protocolized imaging acquisition using computed tomography in conjunction with coordinated stroke care allows for rapid diagnosis and prompt revascularization. Following the initial evidence to support endovascular therapy for large-vessel occlusion, published between 2014 and 2015, there are now guidelines supporting treatment up to 24 hours after time of onset of symptoms. Neuroimaging remains a central component in diagnosing acute stroke and potentially excluding patients from stroke treatment, as outlined in this article.

Causes of Acute Stroke: A Patterned Approach

1093

Ashley Knight-Greenfield, Joel Jose Quitlong Nario, and Ajay Gupta

Acute stroke is a leading cause of morbidity and mortality in the United States. Acute ischemic strokes have been classified according to The Trial of Org 10172 in Acute Stroke Treatment (TOAST) classification system, and this system aids in proper management. Nearly every patient who presents to a hospital with acute stroke symptoms has some form of emergent imaging. As such, imaging plays an important role in early diagnosis and management. This article reviews the imaging patterns of acute strokes, and how the infarct pattern and imaging characteristics can suggest an underlying cause.

Perfusion Computed Tomography in Acute Ischemic Stroke

1109

Jeremy J. Heit, Eric S. Sussman, and Max Wintermark

Occlusion of a cervical or cerebral artery may cause acute ischemic stroke (AIS). Recent advances in AIS treatment by endovascular thrombectomy have led to more widespread use of advanced computed tomography (CT) imaging, including perfusion CT (PCT). This article reviews PCT for the evaluation of AIS patients.

Central Nervous System Vasculopathies

1117

Jennifer E. Soun, Jae W. Song, Javier M. Romero, and Pamela W. Schaefer

Various imaging techniques play a role in the diagnosis of CNS vasculopathies, which comprise a heterogeneous group of disorders, including various noninflammatory and inflammatory etiologies. Noninflammatory vasculopathies include entities such as CADASIL, Susac, moyamoya, fibromuscular dysplasia, vasculopathy of connective tissue disorders, and reversible vasoconstriction syndrome. Inflammatory vasculopathies include vasculitides of different vessel sizes, primary angiitis of the CNS, vasculitis of systemic disease, and vasculitis secondary to specific causes. Miscellaneous etiology includes cerebral amyloid angiopathy, which has noninflammatory and inflammatory subtypes. This article discusses important clinical and imaging findings used to distinguish these disorders.

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Posterior Reversible Encephalopathy Syndrome and Reversible Cerebral Vasoconstriction Syndrome: Distinct Clinical Entities with Overlapping Pathophysiology 1133

Alex Levitt, Richard Zampolin, Judah Burns, Jacqueline A. Bello, and Shira E. Slasky

The clinical and radiologic manifestations of posterior reversible encephalopathy syndrome and reversible cerebral vasoconstriction syndrome are reviewed. The relationship between these entities is discussed. A hypothesis of a common underlying pathophysiology is proposed and substantiated based on the current medical literature.

Adult Primary Brain Neoplasm, Including 2016 World Health Organization Classification 1147

Kevin Yuqi Wang, Melissa M. Chen, and Christie M. Malayil Lincoln

In 2016, the World Health Organization (WHO) central nervous system (CNS) classification scheme incorporated molecular parameters in addition to traditional microscopic features for the first time. Molecular markers add a level of objectivity that was previously missing for tumor categories heavily dependent on microscopic observation for pathologic diagnosis. This article provides a brief discussion of the major 2016 updates to the WHO CNS classification scheme and reviews typical MR imaging findings of adult primary CNS neoplasms, including diffuse infiltrating gliomas, ependymal tumors, neuronal/glioneuronal tumors, pineal gland tumors, meningiomas, nerve sheath tumors, solitary fibrous tumors, and lymphoma.

Primary Neoplasms of the Pediatric Brain 1163

Camilo Jaimes and Tina Young Poussaint

Primary brain tumors are the most common solid malignancy of childhood and constitute the most common cause of cancer-related death in children. It is important for the radiologist to understand the differences between pediatric and adult brain tumors. For instance, tumor type varies significantly with age; many histologic subtypes occur exclusively in childhood. An anatomic approach to pediatric brain tumors helps narrow the differential diagnosis; however, information from this approach must be considered in conjunction with recent advances in molecular subtyping of these tumors. This article emphasizes relevant clinical, molecular, and imaging features that are unique to pediatric brain tumors.

MR Perfusion and MR Spectroscopy of Brain Neoplasms 1177

Karem Gharzeddine, Vaios Hatzoglou, Andrei I. Holodny, and Robert J. Young

Advances in imaging techniques, such as MR perfusion and spectroscopy, are increasingly indispensable in the management and treatment plans of brain neoplasms: from diagnosing, molecular/genetic typing and grading neoplasms, augmenting biopsy results and improving accuracy, to ultimately directing and monitoring treatment and response. New developments in treatment methods have resulted in new diagnostic challenges for conventional MR imaging, such as pseudoprogression, where MR perfusion has the widest current application. MR spectroscopy is showing increasing promise in noninvasively determining genetic subtypes and, potentially, susceptibility to molecular targeted therapies.

Utility of Preoperative Blood-Oxygen-Level-Dependent Functional MR Imaging in Patients with a Central Nervous System Neoplasm 1189

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Functional neuroimaging provides means to understand the relationship between brain structure and associated functions. Functional MR (fMR) imaging can offer a

unique insight into preoperative planning for central nervous system (CNS) neoplasms by identifying areas of the brain effected or spared by the neoplasm. BOLD (blood-oxygen-level-dependent) fMR imaging can be reliably used to map eloquent cortex presurgically and is sufficiently accurate for neurosurgical planning. In patients with brain tumors undergoing neurosurgical intervention, fMR imaging can decrease postoperative morbidity. This article discusses the applications, significance, and interpretation of BOLD fMR imaging, and its applications in presurgical planning for CNS neoplasms.

Imaging Glioblastoma Posttreatment: Progression, Pseudoprogession, Pseudoresponse, Radiation Necrosis **1199**

Sara B. Strauss, Alicia Meng, Edward J. Ebani, and Gloria C. Chiang

Radiographic monitoring of posttreatment glioblastoma is important for clinical trials and determining next steps in management. Evaluation for tumor progression is confounded by the presence of treatment-related radiographic changes, making a definitive determination less straight-forward. The purpose of this article was to describe imaging tools available for assessing treatment response in glioblastoma, as well as to highlight the definitions, pathophysiology, and imaging features typical of true progression, pseudoprogession, pseudoresponse, and radiation necrosis.

Central Nervous System Lesions in Immunocompromised Patients **1217**

Robert Y. Shih and Kelly K. Koeller

Immunodeficiency can affect different components of the immune system and predispose to different types of opportunistic infections. For example, a defect in neutrophil or humoral immunity increases risk from disseminated infection by extracellular pathogens, whereas a defect in cytotoxic activity by natural killer cells or CD8⁺ T lymphocytes increases risk from intracellular pathogens. The latter also increases risk from malignancies, due to impairment of normal immunosurveillance against abnormal neoplastic cells. The purpose of this article is to discuss central nervous system lesions that may be seen in the immunocompromised patient, organized into 5 categories: bacterial, fungal, parasitic, viral, and neoplastic.