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Suresh K. Mukherji

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Tchoyoson Lim

The Changing Epidemiology of Central Nervous System Infection: Can Radiologists Keep Up? 1

Brenda Sze Peng Ang, Thirugnanam Umapathi, and Tchoyoson Lim

Diagnostic radiologists can increase their clinical value by supplementing image pattern recognition with knowledge of epidemiology and geographic distribution of central nervous system (CNS) infections and their causative organisms. This article reviews the changing global disease patterns, as well as zoonotic outbreaks of henipaviruses, coronaviruses, and other emerging, reemerging, and vector-borne organisms; case examples highlight typical imaging features of CNS infections and their mimics. Technical advances in neuroimaging help to enhance the value of radiologists to the multidisciplinary team and the responses to future pandemic preparation.

Neuroimaging Patterns of Intracranial Infections: Meningitis, Cerebritis, and Their Complications 11

Michael Tran Duong, Jeffrey D. Rudie, and Suyash Mohan

Neuroimaging provides rapid, noninvasive visualization of central nervous system infections for optimal diagnosis and management. Generalizable and characteristic imaging patterns help radiologists distinguish different types of intracranial infections including meningitis and cerebritis from a variety of bacterial, viral, fungal, and/or parasitic causes. Here, we describe key radiologic patterns of meningeal enhancement and diffusion restriction through profiles of meningitis, cerebritis, abscess, and ventriculitis. We discuss various imaging modalities and recent diagnostic advances such as deep learning through a survey of intracranial pathogens and their radiographic findings. Moreover, we explore critical complications and differential diagnoses of intracranial infections.

Structured Imaging Approach for Viral Encephalitis 43

Norlisah Mohd Ramli and Yun Jung Bae

MR imaging is essential in diagnosing viral encephalitis. Clinical features, cerebrospinal fluid analysis and pathogen confirmation by polymerase chain reaction can be supported by assessing imaging features. MR imaging patterns with typical locations can identify pathogens such as temporal lobe for herpes simplex virus type 1; bilateral thalami for Japanese encephalitis and influenza virus; and brainstem for enterovirus and rabies. In this article, we have reviewed representative viral encephalitis and its MR imaging patterns. In addition, we also presented acute viral encephalitis without typical MR imaging patterns, such as dengue and varicella-zoster virus encephalitis.

- Acute Neurological Complications of Coronavirus Disease** 57
Sanders Chang, Michael Schecht, Rajan Jain, and Puneet Belani
- The coronavirus disease (COVID-19) pandemic has impacted many lives globally. Neurologic manifestations have been observed among individuals at various stages and severity of the disease, the most common being stroke. Prompt identification of these neurologic diagnoses can affect patient management and prognosis. This article discusses the acute neuroradiological features typical of COVID-19, including cerebrovascular disease, intracerebral hemorrhage, leukoencephalopathy, and sensory neuropathies.
- Coronavirus Disease: Subacute to Chronic Neuroimaging Findings** 69
Monique A. Mogensen and Christopher G. Filippi
- Several neurologic disorders are associated with coronavirus disease 2019 (COVID-19). In this article, clinical syndromes typically occurring in the subacute to chronic phase of illness and their neuroimaging findings are described with discussion of their COVID-19 specific features and prognosis. Proposed pathogenic mechanisms of these neuroimaging findings and challenges in determining etiology are reviewed.
- Imaging of Uncommon Bacterial, Rickettsia, Spirochete, and Fungal Infections** 83
Jitender Saini, Shilpa S. Sankhe, and Aleum Lee
- This article reviews uncommon bacterial (brucellosis, actinomycosis, neuromelioidosis, nocardiosis, whipple disease, and listeriosis), Rickettsia, spirochete (neurosyphilis and Lyme disease), and fungal (mucormycosis, aspergillosis, candidiasis, cryptococcosis, and *Cladophialophora bantiana*) diseases affecting central nervous system (CNS), focusing primarily on their cranial manifestations. These infections often show a variety of neuroimaging features that may be similar or differ from typical pyogenic bacterial meningitis and abscess. Familiarity with these patterns is essential for timely recognition and initiation of appropriate management. Neuroimaging is also useful for identifying complications of CNS infections and follow-up evaluation after initiation of treatment.
- Central Nervous System Mycobacterium Infection: Tuberculosis and Beyond** 105
Mina Park and Rakesh K. Gupta
- Tuberculosis is a contagious infectious disease caused by *Mycobacterium tuberculosis*, and is the leading cause of death from a single infectious agent worldwide. Imaging plays an important role in the early diagnosis of central nervous system tuberculosis and may prevent unnecessary morbidity and mortality. This article presents an extensive review of pathogenesis, clinical symptoms, typical and atypical imaging appearances of intracranial and spinal tuberculosis, and advanced imaging of intracranial tuberculosis. Furthermore, we explore central nervous system infection of nontuberculous mycobacteria and leprosy and their imaging findings.
- Imaging of Central Nervous System Parasitic Infections** 125
Thiago Augusto Vasconcelos Miranda, Kazuhiro Tsuchiya, and Leandro Tavares Lucato
- Parasitic infections of the central nervous system (CNS) constitute a wide range of diseases, some quite prevalent across the world, some exceedingly rare. Causative parasites can be divided into two groups: unicellular protozoa and multicellular

helminthic worms. This includes diseases such as neurotoxoplasmosis and neurocysticercosis, which represent a major cause of pathology among certain populations, and some more uncommon diseases, as primary amebic meningoencephalitis and neuroschistosomiasis. In this review, we focus on imaging manifestation and some helpful clinical and epidemiologic features of such conditions, providing radiologists with helpful information to identify and correctly diagnose the most common of those pathologies.

Human Immunodeficiency Virus: Opportunistic Infections and Beyond

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Rekha Siripurapu and Yoshiaki Ota

Human immunodeficiency virus (HIV) infection causes substantial morbidity and mortality worldwide. Although antiretroviral therapy (ART) has changed the epidemiology of HIV in the last 20 years with increased survival and decreasing incidence of opportunistic infections (OI), CNS OI remain a major cause of morbidity. Improved survival has also increased neurological presentations due to co morbid conditions, treatment related side effects and inflammatory syndromes. Being familiar with the imaging findings, the impact of ART and interpretation of imaging in the context of clinical and laboratory findings is important for radiologists as well as clinicians in the management of HIV-infected patients.

Spinal Infections

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Hajime Yokota and E. Turgut Tali

Spinal cord infections can present with a wide variety of imaging findings, depending on the pathogen and the host's immune status. Infectious myelitis can have a characteristic distribution of lesions within the spinal cord, which refine the differential disease. Some spinal infections do not show typical imaging features, and many noninfectious may mimic spinal infections with similar MR imaging findings. Infectious arachnoiditis and meningitis must be differentiated from neoplasms. Spondylitis has many mimickers and requires careful interpretations of images, clinical findings, and follow-up information.

Imaging of Head and Neck Infections

185

Joel M. Stein and Junfang Xian

The complex anatomy and deep spaces of the head and neck limit physical examination while also offering many points for entry and spread of infection. Radiologic imaging plays a crucial role in managing head and neck infections by defining the location and extent of disease, facilitating abscess drainage, and identifying complications. This review provides essential background and examples for imaging infection throughout the head and neck region.

Imaging of Congenital/Childhood Central Nervous System Infections

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TANG Phua Hwee and THOON Koh Cheng

This article highlights the changing profile of the pediatric patient with central nervous system infection as countries develop and the roles of different imaging modalities such as cranial ultrasound, MR imaging, and computed tomography. It discusses the commonly encountered congenital toxoplasmosis, rubella, cytomegalovirus, herpes simplex (TORCH) infections, Group B Streptococcal and Escherichia coli infections in the neonatal period, and disease outbreaks affecting

children. Iatrogenic, opportunistic, and immune-mediated changes as well as long-term effects of infection and mimics of infection are also discussed. Variety of images is provided to show the range of neuroimaging findings encountered, particularly on cranial ultrasound and MR imaging.

Beyond Pattern Recognition: Radiology-Pathology-Clinical Correlation

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Kum Thong Wong, Chong Tin Tan, and Tchoyoson Lim

Radiology-pathology correlation is essential for multidisciplinary collaboration in diagnosis and understanding the mechanism of CNS damage in infectious processes. The microscopic acute inflammatory processes are well established and are supplemented by a variety of less-invasive microbial and immunohistochemical investigations. Understanding the pathogenesis of pathogen spread and neuroinvasion, vascular and immune-mediated brain, and spinal cord damage are essential for interpreting radiological images.