Radionuclide Imaging of the Central Nervous System

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Purpose
Neuroradiologists need to be familiar with the full range of functional imaging currently available to evaluate suspected central nervous system (CNS) disease and cerebrospinal fluid (CSF) dynamics. Nuclear studies rely upon (1) planar imaging, (2) single photon emission computed tomography (SPECT), and (3) positron emission tomography (PET). Radiologists can correlate these studies with conventional anatomical neuroimaging modalities to arrive at a more complete diagnosis.

Materials & Methods
A retrospective review of patients referred to the Division of Nuclear Medicine at New England Medical Center revealed many cases illustrating the utility of planar, SPECT, and PET imaging in optimizing the evaluation of CNS and CSF pathology. The normal and abnormal biodistributions of various neuroimaging radiopharmaceuticals are explained, and normal and abnormal imaging patterns are illustrated.

Results
Representative cases illustrating the scintigraphic evaluation of CNS and CSF function and dysfunction include: (1) Planar imaging: normal cerebral perfusion (dynamic and static), brain death, normal pressure communicating hydrocephalus (NPH), CSF leaks, verification of diversionary CSF shunt patency; (2) SPECT imaging: normal cerebral perfusion, carotid arterial reserve (during interventional neuroradiologic provocative challenge), acute/subacute/chronic stroke, epilepsy, differentiation of radiation necrosis from tumor, differentiation of lymphoma from infection in HIV-positive patients, various dementias (Alzheimer’s, atrophic, Pick’s, and multi-infarct), psychiatric disorders; (3) PET imaging: tumor recurrence.

Conclusion
The techniques and clinical applications of planar, SPECT, and PET neuroimaging as adjunctive to CT and MR imaging are described, and the scintigraphic patterns of various CNS and CSF system pathologies are illustrated in this exhibit.