NEURORADIOLOGICAL DIAGNOSIS OF MALIGNANT BRAIN TUMORS AND LESIONS THAT MIMIC BRAIN TUMORS

Linda J. Bagley, MD
University of Pennsylvania
GOALS OF IMAGING

• Detection
  • Exclusion of neurosurgical emergency
  • Identification of disease/appropriate staging

• Diagnosis
  • Differentiation of neoplastic from non-neoplastic entities (mimics)
  • Differentiation of primary from secondary malignancies
  • Establishment of specific neoplastic diagnosis (grading/radiophenotype)

• Treatment Planning
  • Extent of lesion
  • Relationship to eloquent cortex/tracts
  • Image guided therapies (gamma knife, cyberknife, thermal ablation, high intensity focused ultrasound)

• Treatment Assessment
  • Determine extent of resection, response to therapies, complications
TOOLS OF IMAGING

- CT scanning
  - Emergency test
  - Exclusion of neurosurgical emergency (hemorrhage, herniation, hydrocephalus)
  - Contraindications to MRI
TOOLS OF IMAGING – CT SCAN
TOOLS OF IMAGING

- MRI
  - Test of choice (gadolinium enhanced)
  - Operative and radiation treatment guidance
  - Advanced techniques including diffusion/DTI, fMRI, perfusion, permeability, and spectroscopy to better characterize lesions, relationship to normal structures and differentiate neoplastic processes from non-neoplastic ones and treatment effects
TOOLS OF IMAGING – MRI
LOW GRADE AND BENIGN NEOPLASMS
PRIMARY CNS MALIGNANCIES
GLIOBLASTOMA – IMAGING FEATURES

- Most common solitary mass in adult without a primary neoplasm
- Cortical infiltration
- Enhancement and necrosis common
- Extension to ependymal surface
- May have restricted diffusion in cellular/solid portions
- May be multifocal-multicentric
- Elevated blood and plasma volume/hypermetabolic
- Elevated Choline
GLIOBLASTOMA
LYMPHOMA

• More common in immunocompromised
• B cell
• Basal ganglia, corpus callosum, ependyma, periventricular white matter
• CT hyperdense, T2 hypointense, solid, enhancing, restricted diffusion, mildly increased blood volume, elevations of lipid/lactate
• Enhancement effected by steroids, immune status
TOOLS OF IMAGING – MRI
LYMPHOMA
TOOLS OF IMAGING MRI - METASTASES
NEOPLASTIC MIMICS

- Infarction
- Infection (herpes, toxoplasmosis, cysticercosis, tuberculosis)
- Vascular (thrombosed aneurysm)
- Inflammatory processes (tumefactive demyelination, sarcoid, vasculitis, amyloid)
- Treatment effects (radiation necrosis, pseudoprogression, immunologic)
NEOPLASTIC MIMIC - INFARCTION
Herpes encephalitis
Clinical presentation
Largely cortical
Spares basal ganglia
Diffusion restricting
Cysticercosis

Varying stages

Calcifications

Not associated with dramatic elevation of blood or plasma volume
NEOPLASTIC MIMIC - THROMBOSE D ANEURYSM
NEOPLASTIC MIMICS - INFLAMMATORY

- Tumefactive demyelination
- Incomplete ring of enhancement
- Leading edge of diffusion restriction
- Multiple lesions
- White matter
NEOPLASTIC MIMICS – TUMEFACTIVE CEREBRAL AMYLOID
TUMEFACTIVE AMYLOID ANGIOPATHY

- Marked edema and mass effect
- Leptomeningeal enhancement
- Multiple foci of hemosiderin deposition
- Responsive to immunosuppression
NEOPLASTIC MIMICS - TREATMENT EFFECTS

- Radiation necrosis
- Diffusely decreased metabolites
- May have slight increases in choline secondary to cell turnover
- Decreased blood and plasma volume
TOOLS OF IMAGING - PET
TREATMENT PLANNING

- Selection of appropriate therapy
  - Location, number of lesions, size of lesion(s)
- DTI, fMRI to guide resective/ablative procedures
- Delineation of eloquent cortex and tracts
IMAGE GUIDED THERAPY
TREATMENT ASSESSMENT

- Post surgical
  - Enhancing and non-enhancing neoplasm
  - Within 48 hrs of surgery
  - Complications
TREATMENT ASSESSMENT

- Pseudoprogression/pseudoresponse
  - Mass effect
  - Time course
  - Clinical status
  - Blood volume, metabolic parameters
TREATMENT ASSESSMENT

- Pseudoprogression/pseudoresponse
  - Mass effect
  - Time course
  - Clinical status
  - Blood volume, metabolic parameters
ACKNOWLEDGEMENT

- Ronald Wolf, MD, PhD