Correlative Imaging in Dementia

Purpose of Imaging Patients With Suspected Dementia Is to Evaluate 2 Groups of Biomarkers:
- Evaluate an underlying molecular pathologic condition (PET).
- Evaluate for evidence of neurodegeneration (MRI).

Structural MRI Imaging:
- Helps exclude non-neurodegenerative etiologies such as vascular diseases.
- Can show evidence of focal atrophy to suggest specific neurodegenerative diseases.
- Quantitative post processing techniques may assist in early diagnosis of neurodegenerative dementia.
- Limitations:
  - Contraindicated in patients with pacemakers and other implanted devices.
  - Degradation of images due to any patient motion.
  - Structural damage may need to occur before it will appear on images, despite cellular damage.

PET F-18FDG:
- Can locate abnormalities before anatomical images may show changes in the brain.
- Limitations:
  - Limited to evaluation of cerebral metabolism.
  - Distribution depends on regional metabolism and blood flow and changes according to synaptic activity and cell density responses; allowing for discrimination of the underlying etiology.
  - Sensitivity to synaptic activity affected by medications and psychiatric illnesses can change or obscure patterns from underlying neurodegeneration.

Amyloid PET:
- Evaluate for the presence of fibrillary β-amyloid deposits, a hallmark of pathologic substrates of Alzheimer’s disease.
- Three agents available for detection of cerebral amyloid.
- Shows detectable cortical uptake with high sensitivity and specificity when a moderate to severe burden of plaque is present.
- Limitations:
  - Cortical amyloid is not specific for the presence of cognitive symptoms, affecting positive predictive values.

Imaging Advancements:
- Voxel-based morphometry: allows for global and regional quantification of brain volume or cortical thickness for MR imaging and of radiotracer distribution and kinetics of PET to better quantify data.
- New tracer development to target other pathologic proteins for neurodegenerative diseases including tau and α-synuclein.