PET/MRI for Neuroendocrine Tumors

Presented By:
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54-year-old female with elevated pancreatic polypeptide. History of hyperparathyroidism and possible MEN 1. She is post parathyroidectomy 5/16/2019.

CECT demonstrates a hypervascular pancreatic tail mass (orange arrow) and two hypervascular liver lesions (blue arrows), possibly metastases vs FNH/adenoma
Staging $^{68}$Ga]DOTATATE-PET/MRI
Staging $^{68}$Ga]DOTATATE-PET/MRI – Hepatobiliary Phase MRI

Focal Nodular Hyperplasia
Neuroendocrine Tumor PET/MRI Protocol

- Whole body PET/MRI protocol
- Axial T1 gradient recall echo (in and out of phase)
- Axial T2 fat-saturated fast spin echo
- Diffusion-weighted images (up to b700)
- Precontrast T1 fat-saturated
- Postcontrast T1 fat-saturated (arterial, portal venous, equilibrium) +/-
- Hepatobiliary phase postcontrast T1
- Magnetic resonance cholangiopancreatography

Comprehensive Protocol

Metastasis-Focused
Abbreviated Protocol
Strengths of Each PET Imaging Modality

**PET/MRI**
- Superior soft tissue characterization
- Superior image co-registration
  - Due to *simultaneous* acquisition of PET and MRI data
- Superior motion artifact correction
  - Respiratory gating
- Whole body and regional imaging in single session
- Can perform clinical 3T MRI

**PET/CT**
- Widespread availability
- Established protocols and indications
- Lower cost
- Theoretical advantage for detection of pulmonary nodules and sclerotic skeletal lesions
Weaknesses of Each PET Imaging Modality

**PET/MRI**
- Reimbursement
  - No specific CPT code for PET/MRI
- Longer imaging acquisition time, challenges for patient comfort and size
  - Can be overcome with optimized protocols
- Newer modality that many clinicians are not familiar with
- Requires dual trained technologists

**PET/CT**
- Extra time needed for PET acquisition
- IV contrast not routinely used at all institutions
  - CT often not diagnostic quality
- May need additional MRI
  - For SOC staging of lung cancer, rectal cancer, and melanoma
- Ionizing radiation
SSTR-PET/MRI for Neuroendocrine Tumors

- Multiple studies have found comparable overall detection rates when comparing PET/CT and PET/MRI (1, 2)
- Some studies have demonstrated superiority: $^{68}\text{Ga}$-DOTATOC PET/MRI yielded a higher proportion of correctly rated NET lesions and provided better NET lesion conspicuity than $^{68}\text{Ga}$-DOTATOC PET/CT (3)
- Can be extremely helpful in ruling in/out lesions in pancreas due to physiologic uptake in the uncinate process

2. Seith et al. La Rad Med. 2018
Multiple studies have shown advantage for PET/MRI in detection of liver metastases as compared to PET/CT (1)
- Likely due to multiphase gadoxetate-enhanced MRI being the most sensitive sequence (2)
- Can be useful in assessing potential differential receptor expression between FDG and SSTR-PET

Mixed data on which is superior in detecting bone lesions
- Some have shown superiority of PET/MRI (1)
- In sclerotic bone lesions, CT has been shown to be more sensitive (3)