Objective

- To highlight practical considerations when performing PET/MRI studies
  - Patient care
  - Workflow
Patient Preparation

- **PET/CT**
  - NPO 4 hours
  - Avoid exercise for 24 hours
  - Exam Duration – 1 hr (Whole Body)

- **MRI**
  - Metal Screening
  - Explain Coil Set up
  - Exam Duration – 1 hr (single study)
Patient Preparation

- PET/MRI
  - NPO 4 hours
  - Avoid exercise 24 hours
  - Metal Screening
  - Explain Coil Set up
  - Exam Duration – 2 Hours
Standard PET/MR Coil Setup
Patient Preparation

- Combination of coil set up and exam length lead to increased concern for patient tolerance.
- Due to concern for PET attenuation entertainment options are limited
  - Music
  - Movie only after head and neck imaging
Patient Preparation

- Increased need for patient to be sedated
  - Ordering MD determines sedation need
    - Sedation
    - General Anesthesia
  - Sedation NP determines if patient is a good candidate for sedation or if GA is recommended
  - Patient seen by Anesthesia prior to exam
  - Patient worked up and cleared for sedation or GA day of exam
Patient Preparation

PET/MR Sedation Breakdown
- Non Sed, 33%
- Sed, 6%
- GA, 61%

PET/CT Sedation Breakdown
- Non Sed, 61%
- Sed, 17%
- GA, 22%
Exam Workflow

- Patients scheduled for 180 minutes
  - 60 min uptake
  - 120 min exam

- Does not include any additional MRI imaging
  - Diagnostic studies of specific body parts require additional time
  - May impact sedation vs GA considerations
  - Break between studies should be considered for non-sedated patients
Exam Workflow

- Uptake 60 minutes
  - Sedation/GA can begin 30min post injection
- Patient brought to room 45min post injection
  - 15 min set up time
  - 5-10 min set up time for MRI or PET/CT
Exam Workflow

PET/MRI Patient Set Up Times

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Exam Workflow

Uptake & Set Up Times

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Exam Workflow

- Whole body localizer
  - 1-5 stations depending on patient height

- Set up PET beds
  - 3 min each bed
  - 25cm PET beds
  - 11% overlap
  - FOV 50
  - 10 beds max
Exam Workflow

- Set up MRI sequences
  - Run simultaneous to PET
  - Determine true duration of each PET bed
  - MRAC (18s)
  - COR STIR (3.5min)
    - Navigated in Chest/Abdomen
      - Increases time
    - Covers 2 PET beds
Exam Workflow

- Gradient T1 weighted Axial (11s)
  - Dixon technique generates Fat Sat and In Phase images

- DWI Axial (2 min)
  - 3 B-values

- T2 Fat Sat Axial (4 min)
  - Only through region of interest
  - Not in conjunction with PET bed
Exam Workflow

- MRI acquisition time approximately 6 minutes
  - 3 minutes in beds without COR STIR
- PET waits on MRI to finish before proceeding.
Exam Workflow

- Set Up 1 bed and begin
  - Must stay ahead of exam to avoid delays
  - Requires exceptional multitasking
  - Very challenging

- Set up 50% of PET beds and begin
  - Allows for better attention to detail
  - Can focus on image quality and patient care
  - Long quiet period for patient between localizer and exam start
Exam Workflow

Average exam plan time: 17 min
Exam Workflow

- Technical Considerations
  - FOV must remain constant for each sequence through each PET bed
  - Center of FOV must remain the same for each sequence through each PET bed
  - All images acquired in true orthogonal planes
    - No angling to compensate for patient anatomy or body habitus
    - Set up patient as straight as possible
Exam Workflow

- FOV is locked to PET bed in the S/I direction
- FOV must be large enough to cover anatomy in every PET bed
  - Decreasing FOV to magnify images increases scan time
- Can vary number of slices but must consider resulting time change
Exam Workflow

PET/MRI Scan Length & Exam Duration

Average Scan Length 1:21, Average Exam Duration 1:36
Exam Workflow

- **Post Processing**
  - Use two accession numbers to expedite reading exam
    - **MR Whole Body (no charge)**
      - All MR images
      - Radiologist checks prior to patient coming off table
    - **PET/MR Whole Body**
      - PET reconstructions
        - Raw and List data can’t be sent to PACS
      - MRI Images
      - Fused Images
Exam Workflow

- Post Processing
  - Bind/Paste MRI data
  - Edit study to change accession number
  - Send all acquired data to PACS under new accession number
  - Fuse PET and MRI data
  - 30 minute process
Data Storage

- Complete study is 5-6 GB
- Since raw PET data can’t cross to PACS need an alternative storage method
- Offsite storage using an NFS mount
Considerations for Future

- Two different exam protocols
  - PET with MRI imaging
  - MRI imaging with PET
  - Would allow for shorter exams depending on focus of exam

- PET/MR Brain
  - 20 minute PET
  - Easier patient setup
  - Gradient T1 Weighted Axial 3D
  - Axial T2 weighted Flair
  - Axial DWI