PET/MR: Pediatric Solid Tumors

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Future is Now: PET/MRI

1st in Children’s Hospital in North America!!
May 2013
TCH Philips Body PET Protocols

PET/CT
- FDG Uptake (60-90 min)
- PET (45 min)
- 1 hr 45 min

MR/PET
- FDG Uptake
- PET
- MRI (45 min)

PET/MR
- FDG Uptake
- PET
- Diffusion MRI

Siemens
GE

MR/PET
- FDG Uptake
- MRI
17 yo Female with Hodgkins Lymphoma
Which Study is from the PET/MR?
A Pilot Study of FDG-PET/MRI For Pediatric Lymphoma

• Inclusion criteria:
  • Pediatric patients with clinical indication for PET/CT for staging or restaging between May 2013 and July 2014.
• 40 Scans from 25 patients (15 male, 10 female; Ages: 5 - 20, mean 14.7 +/- 3.6)
  • 9 patients (10 scans) NHL
  • 16 patients (30 scans) with Hodgkin’s Lymphoma
• Single injection, dual scanning protocol
  • 9 had PET/CT first then PET/MR, 31 were PET/MR then PET/CT
• PET/CT and PET/MR scans were reviewed by 2 radiologists blinded to clinical history and prior imaging.
Lesion Detection:
- No statistically significant difference between PET/CT and PET/MR for lesion detection compared to reference standard

55/56 (98%) of the lesions were detected on PET/CT, 54/56 (96%) on PET/MR

### Results

<table>
<thead>
<tr>
<th></th>
<th>PET/CT</th>
<th>PET/MR</th>
<th>Reference Standard</th>
</tr>
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<tbody>
<tr>
<td>Total Lesions Detected</td>
<td>55</td>
<td>54</td>
<td>56</td>
</tr>
<tr>
<td>Lesions Classified as Malignant</td>
<td>44</td>
<td>42</td>
<td>38</td>
</tr>
<tr>
<td>Lesions Classified as Benign</td>
<td>11</td>
<td>12</td>
<td>18</td>
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Lesion Classification:

- Overall classification accuracy was 82% for both PET/CT and PET/MR

- 50/56 (89%) of the lesions had concordant classification (benign vs. malignant) between PET/MR and PET/CT

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# PET/CT vs PET/MR Radiation Exposure: TCH Experience

<table>
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<tr>
<th>Imaging Exam</th>
<th>Total Scan Dose (mSv)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PET/CT (Low Dose CT)</td>
<td>11-21</td>
</tr>
<tr>
<td>PET/CT + Additional Diagnostic CT</td>
<td>16-31</td>
</tr>
<tr>
<td>PET/CT (High Dose, Diagnostic CT)</td>
<td>17.2</td>
</tr>
<tr>
<td>PET/MR</td>
<td>6-11</td>
</tr>
<tr>
<td>PET/MR + Additional Diagnostic CT</td>
<td>11-21</td>
</tr>
</tbody>
</table>
12 yo male with excision of enlarging mass on occipital scalp: Follicular Lymphoma
3 yo w/ Rosai Dorfman Disease

PET/MR  May 2013
PET/CT
PET/MR  July 2013
PET/CT
Rosai Dorman Screening, cont’d

PET/MR
PET/CT
Oct 2013

PET/MR
PET/CT
Feb 2014
A Pilot Study of FDG-PET/MRI For Langerhans Cell Histiocytosis and Rosai-Dorfman Disease

• 17 Total scans from 9 patients
• All patients received a PET/CT and a PET/MR

<table>
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<tr>
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<th>‘Initial’ Scan</th>
<th>Follow-up scan</th>
<th>Total Number of Scans</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCH</td>
<td>7</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>RDD</td>
<td>2</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td>8</td>
<td>17</td>
</tr>
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- **LCH**
  - 7 ‘initial’ scans: All patients were on therapy or s/p curettage
  - 3 follow up scans done on 3 different patients
- **RDD**
  - 2 ‘initial’ scans: Both patients were on therapy
  - 5 follow-up scans: 4 were done on 1 patient (5/23/13-6/23/14), 1 was done on the second patient (11/15/2013 and 3/3/2014)
Results

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<td>Total Lesions Detected</td>
<td>100</td>
<td>94</td>
<td>101</td>
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<td>76</td>
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• Conclusions:
  • No statistically significant difference in lesion detection or classification between PET/MR and PET/CT
  • Overall accuracies were comparable, measuring 94% in PET/MR and 96% in PET/CT
  • 3 malignant lesions seen on PET/CT were classified as benign on PET/MR. Lesions were from the same RDD patient.
15 yo male w/ left hip pain: Ewing Sarcoma
11 yo male w/ recurrent Medulloblastoma
FDG-PET/MR and Diffusion
FDG-PET/MR and Diffusion