PET/CT Imaging in the Head and Neck Cancer Patient

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Milton J Dance Jr. Head and Neck Center
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Goals

- Discuss CT and PET technology
- Practical information
- Applications in head and neck cancer
What is CT?

- Computerized Tomography
- Aka ‘CAT’ scan
- Uses external ionizing radiation through tissue which is captured and interpreted in a 3-d fashion
- Capitalizes on differential tissue density
- Interfaces are important
Benefits

- Quick, relatively non confining
- Provides excellent anatomic resolution
- Easy access to patients
- Cost is decreasing
- Radiologists are comfortable with this technology
- Good for looking at bone/bony invasion
Disadvantages

- Requires IV contrast for good resolution – must have good renal function
- Dependent on shadows of tissue interface
- Certain areas difficult to see – larynx, tongue base
- Suspicion of malignancy based on size or asymmetry – no functional data gained
What is PET?

- **Positron Emission Tomography**
- Reverses the normal radiologic principles
- Uses gamma counter to measure areas of increased uptake
What are you injecting me with?

- F18 – deoxyglucose (FDG)
- positron emitter
- ½ life of 110 minutes
- 1600 mrem of exposure
Benefits of PET

- Provides functional data
- Less dependent on anatomic resolution
- Pretty pictures
Disadvantages of PET

- Lack of anatomic resolution
- More variability in read – difficult to standardize across centers
- Less accessible
- Costly
- More time
- Requires IV injection and lots of rules
Issues in H&N Radiology

- Lots going on in a small space
- Need for anatomic resolution
- Dependent on size criteria
- Separate scans for neck, chest, abdomen?
Hybrid Power

- Fusion capitalizes on both strengths: anatomic resolution with functional information
- Combine 2 scanners, computer overlays images
Practical PET/CT Issues

- Fast at least 6 hrs prior to scan
- No gum chewing
- No strenuous activity 24 hrs
- Stay for 2-3 hours
- Scan time ~30 minutes
- Diabetes
### Sources of Radiation

<table>
<thead>
<tr>
<th>Where You Live</th>
<th>Common Sources of Radiation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cosmic radiation</strong> (from outer space)</td>
<td>Exposure depends on your elevation (how much air is above you to block radiation). Amounts are listed in mrem (per year).</td>
</tr>
<tr>
<td>At sea level..............26 mrem</td>
<td>2-3000 ft..............35 mrem</td>
</tr>
<tr>
<td>0 - 1000 ft..............28</td>
<td>3-4000 ft..............41</td>
</tr>
<tr>
<td>1-2000 ft..............31</td>
<td>4-5000 ft..............47</td>
</tr>
<tr>
<td>5-6000 ft..............52</td>
<td>5-7000 ft..............66 mrem</td>
</tr>
<tr>
<td>7-8000 ft..............79</td>
<td></td>
</tr>
<tr>
<td>8-9000 ft..............96</td>
<td></td>
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<tr>
<td>[Elevation of cities (in feet): Atlanta 1050; Chicago 595; Dallas 435; Denver 5280; Las Vegas 2000; Minneapolis 815; Pittsburgh 1200; St. Louis 455; Salt Lake City 4400; Spokane 1890.]</td>
<td></td>
</tr>
<tr>
<td><strong>Terrestrial</strong> (from the ground)</td>
<td>If you live in a state that borders the Gulf or Atlantic Coasts, add 16 mrem</td>
</tr>
<tr>
<td>If you live in the Colorado Plateau area (around Denver), add 63 mrem</td>
<td></td>
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<tr>
<td>If you live anywhere else in the continental US, add 30 mrem.</td>
<td></td>
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<tr>
<td><strong>House Construction</strong></td>
<td>If you live in a stone, adobe, brick or concrete building, add 7 mrem</td>
</tr>
<tr>
<td><strong>Power Plants</strong></td>
<td>If you live within 50 miles of a nuclear power plant, add 0.01 mrem</td>
</tr>
<tr>
<td>If you live within 50 miles of a coal-fired power plant, add 0.03 mrem</td>
<td></td>
</tr>
<tr>
<td><strong>Internal Radiation</strong>*</td>
<td>From food (Carbon-14 and Potassium-40) &amp; from water (radon dissolved in water)</td>
</tr>
<tr>
<td>From air (radon)</td>
<td>Weapons test fallout (less than 1)* .................. 1 mrem</td>
</tr>
<tr>
<td>Jet Plane Travel .................. 0.5 mrem per hour in the air</td>
<td></td>
</tr>
<tr>
<td>If you have porcelain crowns or false teeth** .................. 0.07 mrem</td>
<td></td>
</tr>
<tr>
<td>If you wear a luminous wristwatch .................. 0.06 mrem</td>
<td></td>
</tr>
<tr>
<td>If you go through luggage inspection at airport .................. 0.002 mrem</td>
<td></td>
</tr>
<tr>
<td>If you watch TV* .......................... 1 mrem</td>
<td></td>
</tr>
<tr>
<td>If you use video display terminal (computer screen)* .................. 1 mrem</td>
<td></td>
</tr>
<tr>
<td>If you have a smoke detector .................. 0.008 mrem</td>
<td></td>
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<tr>
<td>If you use a gas camping lantern .................. 0.2 mrem</td>
<td></td>
</tr>
<tr>
<td>If you wear a plutonium-powered pacemaker .................. 1.00 mrem</td>
<td></td>
</tr>
</tbody>
</table>
Sample Exposures

- Chest x-ray: 6 mrem
- Chest CT: 500-700 mrem
- Abd & pelvis CT: 1300-1800 mrem
- Nuclear Stress Test: 500-1200 mrem
- Whole body PET: 1600 mrem
- PET/CT: 4300 mrem
- Annual limit: 100 mrem
- XRT worker limit: 5000 mrem
How do we apply this?

- Initial staging workup
  - primary (?)
  - neck
  - distant disease
- Response to treatment
- Surveillance

- Focused questions = focused answer
Unknown Primary

- ~5% of all H&N tumors
- Imaging, office exam, operative exam/biopsies
- 9/31 (29%) detected by PET/CT\(^1\)
- 26/38 suggested primary site, 13/17 histologically confirmed\(^2\)
- 14/44 correctly identified (32%), 5 false pos\(^3\)
- PET alone – 25% detection\(^3\)

2. Warski M et al, Nucl Med Commun. 2007 May;28(5):365-71
### Larynx and PET/CT

**TABLE II.**
Diagnostic Accuracy of Computed Tomography (CT), Positron Emission Tomography (PET), and PET/CT Study-Based Analysis (n = 51).

<table>
<thead>
<tr>
<th></th>
<th>CT</th>
<th>PET</th>
<th>PET/CT</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>89%</td>
<td>92%</td>
<td>92%</td>
<td>NS</td>
</tr>
<tr>
<td>Specificity</td>
<td>8%</td>
<td>73%</td>
<td>96%</td>
<td>*†&lt;.001</td>
</tr>
<tr>
<td>Positive predictive value</td>
<td>52%</td>
<td>76%</td>
<td>96%</td>
<td>*†&lt;.001</td>
</tr>
<tr>
<td>Negative predictive value</td>
<td>40%</td>
<td>90%</td>
<td>92%</td>
<td>.03</td>
</tr>
<tr>
<td>Accuracy</td>
<td>51%</td>
<td>86%</td>
<td>94%</td>
<td>*†&lt;.001</td>
</tr>
</tbody>
</table>

*Between PET and CT.
†Between CT and PET/CT.
‡Between PET and PET/CT. NS = not significant.

Gordin et al.: FDG-PET/CT Imaging for Carcinoma of the Larynx
Mandibular invasion
- 17 patients, T2-4 OC/OP lesions adjacent to mandible
- Sensitivity 100%, specificity 85%

Oral Cavity

- Nodal disease prediction
  - Prospective study of 134 patients clinically NO
  - CT/MRI vs FDG-PET

<table>
<thead>
<tr>
<th>Neck Level Basis</th>
<th>FN (No.)</th>
<th>TP (No.)</th>
<th>TN (No.)</th>
<th>FP (No.)</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Accuracy</th>
<th>PPV</th>
<th>NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>95% CI</td>
<td>%</td>
<td>95% CI</td>
<td>%</td>
<td>95% CI</td>
<td>%</td>
<td>95% CI</td>
<td>%</td>
</tr>
<tr>
<td>CT/MRI</td>
<td>40</td>
<td>11</td>
<td>396</td>
<td>10</td>
<td>21.6</td>
<td>97.5</td>
<td>89.1</td>
<td>52.4</td>
<td>90.8</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>(11.3 to 35.3)</td>
<td>(95.5 to 98.8)</td>
<td>(85.8 to 91.8)</td>
<td>(29.8 to 74.3)</td>
<td>(87.7 to 93.4)</td>
</tr>
<tr>
<td>[18F]FDG PET</td>
<td>30</td>
<td>21</td>
<td>393</td>
<td>13</td>
<td>41.2</td>
<td>96.8</td>
<td>90.6</td>
<td>61.8</td>
<td>92.9</td>
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<td>(27.6 to 55.8)</td>
<td>(94.6 to 98.3)</td>
<td>(87.5 to 93.1)</td>
<td>(43.6 to 77.8)</td>
<td>(90.0 to 95.2)</td>
</tr>
<tr>
<td>CT/MRI + [18F]FDG PET</td>
<td>27</td>
<td>24</td>
<td>398</td>
<td>8</td>
<td>47.1</td>
<td>98.0</td>
<td>92.3</td>
<td>75.0</td>
<td>93.6</td>
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<td>(32.9 to 61.5)</td>
<td>(96.2 to 99.1)</td>
<td>(89.5 to 94.6)</td>
<td>(56.6 to 88.5)</td>
<td>(90.9 to 95.8)</td>
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<tr>
<td>Patient basis</td>
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<tr>
<td>CT/MRI</td>
<td>24</td>
<td>11</td>
<td>91</td>
<td>8</td>
<td>31.4</td>
<td>91.9</td>
<td>76.1</td>
<td>57.9</td>
<td>79.1</td>
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<td></td>
<td>(16.9 to 49.3)</td>
<td>(84.7 to 96.4)</td>
<td>(68.0 to 83.1)</td>
<td>(33.5 to 79.7)</td>
<td>(70.6 to 86.1)</td>
</tr>
<tr>
<td>[18F]FDG PET</td>
<td>17</td>
<td>18</td>
<td>91</td>
<td>8</td>
<td>51.4</td>
<td>91.9</td>
<td>81.3</td>
<td>69.2</td>
<td>84.3</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>(34.0 to 68.6)</td>
<td>(84.7 to 96.4)</td>
<td>(73.7 to 87.5)</td>
<td>(48.2 to 85.7)</td>
<td>(76.0 to 90.6)</td>
</tr>
<tr>
<td>CT/MRI + [18F]FDG PET</td>
<td>15</td>
<td>20</td>
<td>95</td>
<td>4</td>
<td>57.1</td>
<td>96.0</td>
<td>85.8</td>
<td>83.3</td>
<td>86.4</td>
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<td></td>
<td></td>
<td>(39.4 to 73.7)</td>
<td>(90.0 to 98.9)</td>
<td>(78.7 to 91.2)</td>
<td>(62.6 to 95.3)</td>
<td>(78.5 to 92.2)</td>
</tr>
</tbody>
</table>
Oral Cavity and Nodal Disease

- 82 patients enrolled retrospectively, 67 had neck dissections
- Compared against CT/MRI

Distributions of Nodal Status, Recurrence, and Survival

Clinically N+ (n = 25)
- 29 neck dissections (21 unilateral, 4 bilateral)
  - 21 metastatic (n = 21)
    - 21 PET +
    - 0 PET -
    - 7 LR, 7 RR, 3 DM (n = 11)
    - 11 DOD
  - 8 negative (n = 6)
    - 6 PET +
    - 2 PET -
    - 1 DM
    - 1 DOD

Clinically N0 (n = 57)
- 46 neck dissections (38 unilateral, 4 bilateral)
  - 11 metastatic (n = 11)
    - 6 PET +
    - 5 PET -
    - 2 LR, 2 RR, 1 DM (n = 3)
    - 3 DOD
  - 35 negative (n = 31)
    - 4 PET +
    - 31 PET -
    - 3 LR, 1 RR (n = 3)
    - 4 DOD
    - 1 LR, 4 RR (n = 4)

No neck dissection (n = 15)
- 1 PET +
- 14 PET -
- 1 LR, 1 DM (n = 1)

LR, local recurrence; RR, regional recurrence; DM, distant metastasis; DOD, died of disease
Results of CT/MRI and FDG PET and histological correlation in 67 patients who underwent neck dissection

<table>
<thead>
<tr>
<th>Group and imaging modality</th>
<th>TP</th>
<th>FP</th>
<th>FN</th>
<th>TN</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
<th>Accuracy (%)</th>
<th>PPV (%)</th>
<th>NPV (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>By the presence of positive neck side</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CT/MRI</td>
<td>21</td>
<td>8</td>
<td>11</td>
<td>35</td>
<td>65 (46–81)</td>
<td>81 (66–91)</td>
<td>75 (56–86)</td>
<td>72 (52–87)</td>
<td>76 (61–87)</td>
</tr>
<tr>
<td>FDG PET</td>
<td>27</td>
<td>10</td>
<td>5</td>
<td>33</td>
<td>84 (67–94)</td>
<td>77 (61–88)</td>
<td>80 (64–91)</td>
<td>72 (55–86)</td>
<td>87 (71–95)</td>
</tr>
<tr>
<td>By the presence of positive cervical levels</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CT/MRI</td>
<td>28</td>
<td>15</td>
<td>15</td>
<td>217</td>
<td>65 (49–78)</td>
<td>94 (89–96)</td>
<td>89 (67–93)</td>
<td>65 (49–78)</td>
<td>94 (89–96)</td>
</tr>
<tr>
<td>FDG PET</td>
<td>38</td>
<td>17</td>
<td>5</td>
<td>215</td>
<td>88 (74–96)</td>
<td>93 (88–95)</td>
<td>92 (81–95)</td>
<td>69 (55–80)</td>
<td>98 (94–99)</td>
</tr>
</tbody>
</table>
Initial Nodal Detection

- Jeong et al – 47 patients, 242 neck levels dissected.
  - N stage corrected in 15% (7/47)

Jeong HS et al. Head Neck. 2007 Mar;29(3):203.10
Jeong HS et al. Head Neck. 2007 Mar;29(3):203.10
However...

- 13-15% would have residual disease
- Wensing et al\textsuperscript{1} – 26 patients, T1-4N0, compared FDG-PET with pathology
  - Sensitivity = 33%, specificity = 76%, NPV = 80%
- Krabbe et al\textsuperscript{2} – sensitivity 50%
- Schoder et al\textsuperscript{3} – 36 necks, T1-4N0, compared to FDG-PET with pathology

Distribution of Findings

31 patients with N0 neck underwent elective neck dissection

36 neck dissections (26 unilateral, 5 bilateral)

36 neck sides

9 metastatic
- 6 PET +
- 3 PET -

27 negative
- 4 PET +
- 23 PET -

142 nodal levels

9 metastatic
- 6 PET +
- 3 PET -

133 negative
- 6 PET +

Sensitivity: 67%
Specificity: 85%

Sensitivity: 67%
Specificity: 95%

## Metastasis

**TABLE I. FDG-PET Detection of Distant Metastases and Second Primary Carcinomas**

<table>
<thead>
<tr>
<th>References</th>
<th>N</th>
<th>PET finding</th>
<th>Distant met</th>
<th>2nd primary</th>
<th>True positive</th>
<th>False positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yen et al. [2]</td>
<td>118</td>
<td>24</td>
<td>14</td>
<td>NR</td>
<td>14/24</td>
<td>10/24</td>
</tr>
<tr>
<td>Goerres et al. [3]</td>
<td>34</td>
<td>8</td>
<td>3</td>
<td>4</td>
<td>7/8</td>
<td>1/8</td>
</tr>
<tr>
<td>Schmid et al. [4]</td>
<td>48</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>4/6</td>
<td>2/6</td>
</tr>
<tr>
<td>Schwartz et al. [5]</td>
<td>21</td>
<td>7</td>
<td>4</td>
<td>3</td>
<td>7/7</td>
<td>0/7</td>
</tr>
<tr>
<td>Teknos et al. [6]</td>
<td>12</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>3/3</td>
<td>0/3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>233</td>
<td>48, 21%</td>
<td>26</td>
<td>9</td>
<td>35/48, 73%</td>
<td>13/48, 27%</td>
</tr>
</tbody>
</table>

- Does not compare vs CT or other standard tests

92 patients who developed distant metastasis, chest CT vs PET for initial workup
- Higher sensitivity (53% vs 37%)
- Higher PPV (53% vs 37%)
- Detected 7% more lesions, and 6/6 synchronous primary tumors
- (PET + CT was the best)

Senft A et al. Radiother Oncol. 2008 May;87(2):221-9
Metastasis cont.

- 349 patients with untreated HNC \(^1\)
  - 14 (4\%) with second primary tumors
  - 26 (7.4\%) with metastatic disease
  - Sensitivity 97.5\%, specificity 92.6\%
  - PPV – 62.9\%, NPV 99.7\%

- Whole body PET/CT may also detect other lesions (up to 1.2\%) \(^2\)

## Staging

<table>
<thead>
<tr>
<th></th>
<th>Correctly staged patients/95%-CI</th>
<th>Overstaged patients</th>
<th>Understaged patients</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TNM stage</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PET/CT</td>
<td>34/49/55%-82%</td>
<td>6/49</td>
<td>9/49</td>
</tr>
<tr>
<td>PET+CT</td>
<td>23/49/33%-62%</td>
<td>7/49</td>
<td>19/49</td>
</tr>
<tr>
<td>CT</td>
<td>15/49/18%-45%</td>
<td>7/49</td>
<td>27/49</td>
</tr>
<tr>
<td><strong>T stage</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PET/CT</td>
<td>44/49/78%-97%</td>
<td>2/49</td>
<td>3/49</td>
</tr>
<tr>
<td>PET+CT</td>
<td>32/49/50%-78%</td>
<td>4/49</td>
<td>13/49</td>
</tr>
<tr>
<td>CT</td>
<td>24/49/34%-64%</td>
<td>5/49</td>
<td>20/49</td>
</tr>
<tr>
<td><strong>N stage</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PET/CT</td>
<td>38/49/63%-88%</td>
<td>5/49</td>
<td>6/49</td>
</tr>
<tr>
<td>PET+CT</td>
<td>34/49/55%-82%</td>
<td>8/49</td>
<td>7/49</td>
</tr>
<tr>
<td>CT</td>
<td>30/49/46%-75%</td>
<td>7/49</td>
<td>12/49</td>
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<tr>
<td><strong>M stage</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PET/CT</td>
<td>48/49/89%-100%</td>
<td>1/49</td>
<td>0/49</td>
</tr>
<tr>
<td>PET+CT</td>
<td>47/49/86%-100%</td>
<td>2/49</td>
<td>0/49</td>
</tr>
<tr>
<td>CT</td>
<td>48/49/89%-100%</td>
<td>0/49</td>
<td>1/49</td>
</tr>
</tbody>
</table>

Staging

- Altered treatment in 13/55 (24%) of patients compared to CT alone\(^1\)
- Provides additional information that altered treatment plan in 11/36 (31%) of patients\(^2\)
- 38/123 (31%) patients had treatment altered – canceled surgery 19/123\(^3\)

Summary of Initial Staging

- May be useful in select cases to identify/characterize the primary
- Not good enough in the neck to direct surgical therapy
- Helps identify metastases/second primary tumors
- Can alter ultimate treatment course
PET/CT response to therapy

- After definitive therapy – chemorads or surgery
- Must be done after inflammation resolves
- Can we rely on PET/CT?
<table>
<thead>
<tr>
<th></th>
<th>FDG-PET/CT</th>
<th>CT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Between 4 and 8 weeks (n = 17)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensitivity (%)</td>
<td>66.7</td>
<td>88.9</td>
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<tr>
<td>Specificity (%)</td>
<td>87.5</td>
<td>62.5</td>
</tr>
<tr>
<td>Positive predictive value (%)</td>
<td>85.7</td>
<td>72.7</td>
</tr>
<tr>
<td>Negative predictive value (%)</td>
<td>70.0</td>
<td>83.3</td>
</tr>
<tr>
<td>Accuracy (%)</td>
<td>76.5</td>
<td>76.5</td>
</tr>
<tr>
<td><strong>Later than 8 weeks (n = 11)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensitivity (%)</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Specificity (%)</td>
<td>100</td>
<td>28.6</td>
</tr>
<tr>
<td>Positive predictive value (%)</td>
<td>100</td>
<td>44.4</td>
</tr>
<tr>
<td>Negative predictive value (%)</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Accuracy (%)</td>
<td>100</td>
<td>54.5</td>
</tr>
</tbody>
</table>
# Response to therapy

## TABLE II. FDG-PET Detection of Recurrent Head and Neck Cancer

<table>
<thead>
<tr>
<th>References</th>
<th>N</th>
<th>Prior Rx</th>
<th>Sensit. (%)</th>
<th>Spec. (%)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farber et al. [11]</td>
<td>28</td>
<td>Any</td>
<td>86</td>
<td>93</td>
<td>Better than CT/MRI</td>
</tr>
<tr>
<td>Li et al. [12]</td>
<td>43</td>
<td>RT</td>
<td>91</td>
<td>86</td>
<td>Better than CT/MRI</td>
</tr>
<tr>
<td>Lonneux et al. [13]</td>
<td>44</td>
<td>Any</td>
<td>96</td>
<td>61</td>
<td>Prospective</td>
</tr>
<tr>
<td>Lowe et al. [14]</td>
<td>44</td>
<td>ChemoRT ± Surg</td>
<td>100</td>
<td>93</td>
<td>Larynx and HP</td>
</tr>
<tr>
<td>Stokkel et al. [15]</td>
<td>48</td>
<td>RT</td>
<td>100</td>
<td>71</td>
<td></td>
</tr>
<tr>
<td>Lapela et al. [16]</td>
<td>56</td>
<td>Any</td>
<td>84–95</td>
<td>84–93</td>
<td>Prospective</td>
</tr>
<tr>
<td>Terhaard et al. [17]</td>
<td>75</td>
<td>RT</td>
<td>97</td>
<td>82</td>
<td></td>
</tr>
<tr>
<td>Wong et al. [18]</td>
<td>143</td>
<td>Any</td>
<td>96</td>
<td>72</td>
<td>SUV prognostic</td>
</tr>
</tbody>
</table>

Our data

- 37 neck sides evaluated
- PPV = 57.1%, NPV = 73.9%

TABLE III: Correlation Between PET/CT and Pathology

<table>
<thead>
<tr>
<th>Pathologic Evaluation of Residual Disease</th>
<th>Positive</th>
<th>Negative</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive PET/CT</td>
<td>8</td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td>Negative PET/CT</td>
<td>6</td>
<td>17</td>
<td>23</td>
</tr>
<tr>
<td>Total</td>
<td>14</td>
<td>23</td>
<td>37</td>
</tr>
</tbody>
</table>
Response after chemoradiotherapy

- Neck status remains unclear
  - half of studies demonstrate NPV of 95-100%
  - the other half disagree
- No consensus at this time to utilize PET/CT findings to dictate neck treatment
Prognostic Value

- 143 patients followed by PET after treatment\(^1\)
  - PET and SUV were independent predictors of survival
- 54 patients with initial PET scan – primary tumor SUV>9.0 = higher local recurrence and disease-free survival\(^2\)

Role for detection of recurrence

- 49 patients with suspected recurrence, compared PET vs PET/CT.
  - 36 SCC, 8 PTC, 5 salivary gland
- 110 lesions – 67/110 (61%) positive, 43 (39%) negative
- Sensitivity of 84%; specificity of 95%; PPV 97%; NPV 79%
- Concluded not much better than PET alone, but did provide anatomic localization

Halpern BS et al. Eur J Radiol. 2007 May;62(2):199-204
Recurrence

- 32 patients treated for HNSC, compared PET to PET/CT
  - Mean of 25 months to time of scan
  - PET/CT PPV 74%, NPV 89%
  - PET/CT better than PET alone\(^1\)

- 25 patients with biopsy or surgery after suspected recurrence, 22 months out from therapy
  - 19 local recurrence, 10 regional, and 3 distant
  - Sensitivity 95%, spec 60%, PPV 90, NPV96%\(^2\)

1. Fakhry N et al, Eur Arch Otorhinolaryngol. 2007 May;264(5):531-8
Routine Follow-up

- Only one publication listed their protocol: 2 months, 5 months, 8 months, 14 months*
- No data published on longer term followup
- **Unknown role at this time**

Conclusions

- PET/CT interesting technology
- Allows for best of both worlds
- Good for initial workup
- Good for distant disease
- Good for worrisome recurrent disease
- Borderline for neck management after chemoradiation
- Unknown for routine surveillance
Further conclusions

- Needs further study – is it necessary for all stages/subsites, should we always scan the abdomen?
- Requires clinical judgment and interpretation
- Must have focused question to be answered
Questions?