AMSER Case of the Month
November 2020

75 year-old female with a history of metastatic neuroendocrine tumor and episodic severe pain.

Samuel Orchard, MS3
University of Utah School of Medicine

Dr. Gabriel Fine, MD
Dr. Jeffrey Olpin, MD
University of Utah Health
Department of Radiology
Patient Presentation

• HPI
  • 75 year-old woman with a history of metastatic neuroendocrine tumor and recent episodic pain and diarrhea. Presents for tumor progression follow-up and to discuss new treatment options.

• PMH
  • Anemia, arthritis, liver disease, measles, migraine

• Medications
  • Creon 3x daily with meals, Sumatriptan 100 mg as needed, Excedrin

• Oncological History
  • Diagnosed with metastatic small bowel neuroendocrine tumor in 2010, grade 1
  • 2/2010 resection of primary and bulk of her mesenteric disease with debulking of liver mets
  • Started on somatostatin LAR on 04/2010 then switched to lanreotide on 08/2017 and continues now
  • 2/2018 duodenoejunal bypass
What Imaging Should We Order?
Select the applicable ACR Appropriateness Criteria

### Indeterminate, greater than 1 cm liver lesion on initial imaging with CT (noncontrast or single-phase) or noncontrast MRI. Known history of an extrahepatic malignancy.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Appropriateness Category</th>
<th>Relative Radiation Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRI abdomen without and with IV contrast</td>
<td>Usually Appropriate</td>
<td>0</td>
</tr>
<tr>
<td>CT abdomen with IV contrast multiphase</td>
<td>Usually Appropriate</td>
<td>★★★★</td>
</tr>
<tr>
<td>FDG-PET/CT skull base to mid-thigh</td>
<td>Usually Appropriate</td>
<td>★★★★</td>
</tr>
<tr>
<td>US abdomen</td>
<td>May Be Appropriate</td>
<td>0</td>
</tr>
<tr>
<td>US abdomen with IV contrast</td>
<td>May Be Appropriate</td>
<td>0</td>
</tr>
<tr>
<td>Percutaneous image-guided biopsy liver</td>
<td>May Be Appropriate</td>
<td>Varies</td>
</tr>
<tr>
<td>CT abdomen without and with IV contrast</td>
<td>May Be Appropriate</td>
<td>★★★★</td>
</tr>
<tr>
<td>DOTATATE PET/CT skull base to mid-thigh</td>
<td>May Be Appropriate</td>
<td>★★★★</td>
</tr>
<tr>
<td>Octreotide scan with SPECT or SPECT/CT chest and abdomen</td>
<td>May Be Appropriate</td>
<td>★★★★</td>
</tr>
<tr>
<td>Liver scan scan</td>
<td>Usually Not Appropriate</td>
<td>★★★★</td>
</tr>
<tr>
<td>RBC scan abdomen and pelvis</td>
<td>Usually Not Appropriate</td>
<td>★★★★</td>
</tr>
</tbody>
</table>

This imaging modality was ordered by the physician.

### Prospective Study of 68Ga-DOTATATE Positron Emission Tomography/Computed Tomography for Detecting Gastro-Entero-Pancreatic Neuroendocrine Tumors and Unknown Primary Sites

**Special Imaging Considerations**

A positron-emitting radioisotope-labeled somatostatin analogue called Ga-68-DOTATATE utilized in PET/CT is designed to image neuroendocrine tumors (NETs). It offers a higher spatial resolution and considerably shorter imaging times compared with In-111 somatostatin receptor or metiodobenzylguanidine scintigraphy [8].
Findings (unlabeled)

2018

Dotatate PET/CT

2020

Dotatate PET/CT
Progressive disease with at least one new hepatic lesion with increased size and avidity associated with multiple hepatic metastatic lesions.
Progressive disease with increased size and avidity associated with left level IV cervical node.
Final Dx:

Metastatic, well-differentiated, grade 1, small bowel neuroendocrine tumor
Neuroendocrine Tumors

- **Incidence**
  - 7.8 per 100,000/yr

- **Prevalence**
  - 35 per 100,000

- **Grading**
  - Based on mitotic index and Ki-67 index determined by pathologist

- **Presentation**
  - Carcinoid symptoms – diarrhea, flushing
  - Tumor growth symptoms – SBO, early satiety, RUQ pain, hepatomegaly
Detecting Neuroendocrine Tumors: Gallium-68 Dotatate PET/CT

• What is Gallium 68 Dotatate?
  • Radioactive analog of the hormone somatostatin
  • Preferred imaging technique for NET by the North American Neuroendocrine Tumor society

• Other options?
  • (111)In-pentetreotide SPECT/CT and anatomic imaging (Multiphasic CT and/or MRI)
  • G68 Dotatate found to have a much higher detection rate
    • G68 Dotatate – 95.1%
    • (111)In-pentetreotide SPECT/CT – 30.9%
    • Anatomic imaging – 45.3%
Management

- Local, small tumor
  - Resection
  - Most small tumors (<2 cm) won’t metastasize, but up to 30% of large tumors have already metastasized at diagnosis

- Metastatic disease
  - Somatostatin analogs (octreotide, lanreotide) – effective at treating carcinoid syndrome as well as controlling tumor growth
  - Molecular targeted therapy i.e. anti-VEGF
  - Peptide receptor radioligand therapy
    - Lutetium Lu-177 dotatate
Mechanism of action of LUTATHERA™

LUTATHERA binds to somatostatin receptors, with highest affinity for subtype 2 receptors, that are expressed on the surface of GEP-NET cells. Upon binding to somatostatin receptor-expressing cells, LUTATHERA is internalized. The beta emission from LUTATHERA induces cellular damage by formation of free radicals in somatostatin receptor-positive cells and in neighboring cells.

1. LUTATHERA is infused into the bloodstream.
2. LUTATHERA binds to cells expressing somatostatin receptors, including GEP-NET cells.
3. LUTATHERA is internalized into somatostatin receptor-bearing cells...
4. ...where it delivers beta radiation.
5. The radiation causes damage in somatostatin receptor-positive cells and neighboring cells.
References:


