Management of Neuroendocrine Tumors

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## Stage at Diagnosis

### SEER vs. University of Iowa

<table>
<thead>
<tr>
<th>Primary tumor site</th>
<th>Localized</th>
<th>Regional</th>
<th>Distant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung</td>
<td>49</td>
<td>23</td>
<td>28</td>
</tr>
<tr>
<td>Thymus</td>
<td>28</td>
<td>41</td>
<td>31</td>
</tr>
<tr>
<td>Stomach</td>
<td>76</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>Duodenum</td>
<td>81</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Jejunum/ileum</td>
<td>29</td>
<td>41</td>
<td>30</td>
</tr>
<tr>
<td>Cecum</td>
<td>14</td>
<td>42</td>
<td>44</td>
</tr>
<tr>
<td>Appendix</td>
<td>60</td>
<td>28</td>
<td>12</td>
</tr>
<tr>
<td>Colon</td>
<td>45</td>
<td>23</td>
<td>32</td>
</tr>
<tr>
<td>Rectum</td>
<td>92</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Pancreas</td>
<td>14</td>
<td>22</td>
<td>64</td>
</tr>
<tr>
<td>Liver</td>
<td>45</td>
<td>27</td>
<td>28</td>
</tr>
</tbody>
</table>

*Yao et al. J. Clin. Oncology 26:3063, 2008*
Small Bowel Neuroendocrine Tumors (SBNETs)
SBNETs

- Most common GI site
- Incidence 12 per million
- 50% multicentric
- Well-differentiated
- Indolent but present late
Work-Up

- History and Physical
- Blood Tests
- Imaging
  - CT---best overall test
  - MRI---better for liver mets
  - $^{68}$Ga-DOTATATE-PET---functional testing; mets
  - $^{18}$FDG-PET---high-grade
Exploration

Locations of SBNETs: Unifocal and Multifocal

Locoregional Spread

Intestinal Blood Supply from Superior Mesenteric Vessels

www.liliententhalusa.com
Nodal Dissection

Lymphadenopathy

Nodes

SMV
SMA
Open Approach with Small Incision

Enlarged Node
Cholecystectomy at Exploration

- Somatostatin analogues lead to gallstones
- Hepatic embolization can result in GB necrosis
Pancreatic Neuroendocrine Tumors (PNETs)
Pancreatic Neuroendocrine Tumor

Figure 16.7

- Portal vein
- Hepatic artery
- Splenic artery
- Pancreas
- GDA
- Portal vein canal
- Gastroepiploic vein
- Middle colic vein
- SMV
- IMV (Variable position)
- Splenic vein

J. Howe, ed. Atlas of Endocrine and Neuroendocrine Surgery, Springer-Verlag 2017
General Facts About PNETs

Halfdanarsan, TR et al.  
# Familial PNETs

## Familial syndromes associated with PanNETs

<table>
<thead>
<tr>
<th>Familial syndrome</th>
<th>Affected gene</th>
<th>Prevalence of PanNETs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple endocrine neoplasia type 1</td>
<td>MEN1</td>
<td>30-80 %</td>
</tr>
<tr>
<td>Von Hippel–Lindau disease</td>
<td>VHL</td>
<td>10-17%</td>
</tr>
<tr>
<td>Neurofibromatosis type 1</td>
<td>NFI</td>
<td>10%</td>
</tr>
<tr>
<td>Tuberous sclerosis</td>
<td>TSC1 or TSC2</td>
<td>1%</td>
</tr>
</tbody>
</table>

Pancreatic Neuroendocrine Tumors

- Non-functional
- Insulinoma
- Gastrinoma
- VIPoma
- Glucagonoma
- Somatostatinoma
- Pancreatic Polypeptide?
Diagnosis of PNETs

- Symptoms
- Imaging Tests
- Biochemical testing
- Biopsy: Endoscopic US or CT
When to Resect PNETs

- Functional lesions
  - >2 cm
  - Not < 1 cm
  - Controversy in 1-2 cm
  - >2 cm in MEN1
  - >3 cm in VHL

Surgical Treatment Options

- Enucleation
- Distal Pancreatectomy
- Pancreaticoduodenectomy (Whipple)
- Laparoscopic distal pancreatectomy
Enucleation

Figure 18.5

Body of pancreas

Cauterize vessels on tumor
Clip vessels on pancreas

Islet cell tumor

Shelling out of islet cell tumor

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Enucleation
Surgical Treatment of Pancreatic Body/Tail Lesions
CT: Pancreatic Body/Tail Mass

Tumor
Distal Pancreatectomy/Splenectomy

Figure 16.9

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Pathology Specimen: Distal Pancreas and Spleen

Pancreatic Margin >1 cm

Tumor

Spleen
Surgical Treatment of Pancreatic Head Lesions
PNET in Pancreatic Head

- Primary Node
- Tumor
- Duodenum
- Node
- Tumor thrombus
Pancreatic Anastomosis

Bile Duct Anastomosis

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Gastrojejunal Anastomosis

The Role of Laparoscopy for PNETs

- Especially good for small, distal lesions
- Can also enucleate
- Well-suited for distal pancreatectomy/splenectomy

Liver Metastases

Transverse View

Sagittal View
Options for Liver Metastases

- Embolization
- Radioembolization
- Peptide Receptor Radiotherapy (PRRT)
- Somatostatin analogues
- Systemic therapy
- Resection, enucleation, ablation
Microwave Ablation

Ultrasound with needle guide (black)
Aculis probe (white)

Ultrasound view of probe traversing lesion
Microwave Ablation

30 seconds at 100W

60 seconds at 100W
Hepatic Cytoreduction

- Not Just for Symptoms
- Improves Survival
- Cytoreduction target: >70-90%
- Parenchymal Sparing reasonable
- <10 lesions do better
- <25% replacement do better

High Recurrence Rates in the liver---94% at 5 yrs.
Summary: Optimal Surgical Approach to NETs

- Remove the primary
- Resect regional nodes
- Cholecystectomy
- Cytoreduce liver metastases
- Use Somatostatin analogues
- Use systemic therapy*

*when other options not feasible or at progression
Overall Survival

University of Iowa
NeuroEndocrine Cancer Clinic

- Thomas O’Dorisio-Endocrinology
- James Howe-Surgical Oncology
- Sue O’Dorisio-Pediatric Oncology
- C. Chandrasekharan-Medical Oncology
- Joseph Dillon-Endocrinology
- Andrew Bellizzi-Pathology
- Jackie Sexton, Kim Miller-Nursing
- NIH SPORE P50 CA174521-01
Thanks from Iowa!!