PET-CT of the pancreas: *The “hot spots”, the “cold spots”, the “blind spots”*

A quiz based review.

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Goals and Objectives

• Depict the role of PET-CT in pancreatic malignancy:
  – Initial staging (local spread and distant metastases)
  – Restaging and assessing treatment response

• Understanding artefacts and potential pitfalls.

Target audience: Abdominal imagers, oncologic imagers, nuclear medicine physicians, residents and fellows

Disclosures: None
Identify the findings present on the following images:

**CT:**
- Pancreatic mass
- Vascular encasement
- Ductal dilatation
- Distant metastases
- Pancreatitis associated fluid collections

**PET-CT:**
- Hypermetabolic pancreas focus
- Vascular encasement
- Ductal dilatation
- Distant metastases
- Pancreatitis associated fluid collections
Identify the findings present on the following images:

**CT:**
- Pancreatic mass
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**PET-CT:**
- Hypermetabolic pancreas focus
- Vascular encasement
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- Distant metastases
- Pancreatitis associated fluid collections
Teaching points

• Contrast enhanced CT has been demonstrated to be superior to PET-CT in diagnosing vascular encasement.

• Crucial for establishing tumor resectability.

• PET-CT example demonstrates hypermetabolic focus encasing the SMA ostial calcifications.

• **Merits of PET-CT**: Close attention on PET-CT may provide highly useful clues, when contrast enhanced CT may not be available.
Identify the findings present on the following images:

**CT:**
- Pancreatic mass
- Pancreatitis
- Vascular encasement
- Ductal dilatation
- Distant metastases
- Pancreatitis associated fluid collections

**PET-CT:**
- Pancreatic mass
- Pancreatitis
- Vascular encasement
- Ductal dilatation
- Distant metastases
- Pancreatitis associated fluid collections
Imaging findings

CT:
- ✔ Pancreatic mass
- ✔ Pancreatitis
- □ Vascular encasement
- ✔ Ductal dilatation
- □ Distant metastases
- □ Pancreatitis associated fluid collections

PET-CT:
- ✔ Pancreatic mass
- ✔ Pancreatitis
- □ Vascular encasement
- □ Ductal dilatation
- □ Distant metastases
- □ Pancreatitis associated fluid collections
Teaching points

• Hypermetabolic pancreatic mass on CT and PET-CT.

• Upstream ductal dilatation is present on CT.

• Fat stranding around the distal pancreas with low grade FDG uptake.

• **Merits of PET-CT:** Pancreatic masses can obstruct the pancreatic ducts and cause post-obstructive pancreatitis. PET-CT helps identify the exact extent of the mass and differentiate it from post-obstructive inflammatory changes.
Identify the findings present on the following images:

**CT:**
- Pancreatic mass
- Vascular encasement
- Ductal dilatation
- Liver mass
- Serosal implant
- Pancreatitis associated fluid collections

**PET-CT:**
- Pancreatic mass
- Vascular encasement
- Ductal dilatation
- Liver mass
- Serosal implants
- Pancreatitis associated fluid collections
Identify the findings present on the following images:

**CT:**
- Pancreatic mass
- Vascular encasement
- Ductal dilatation
- Liver mass
- Serosal implant
- Pancreatitis associated fluid collections

**PET-CT:**
- Pancreatic mass
- Vascular encasement
- Ductal dilatation
- **Liver mass**
- **Serosal implants**
- Pancreatitis associated fluid collections
Teaching points

• Hypermetabolic pancreatic mass on CT and PET-CT.

• Hypermetabolic liver masses are seen.

• Multifocal hypermetabolic implants are seen at the hepatic surface.

• **Merits of PET-CT:** Small metastases (<2 cm) and serosal implants may be difficult to identify on PET-CT. FDG uptake within these metastases, make them readily identifiable at PET-CT, allowing for accurate staging.
Identify the findings present on the following images:

CT:
- Post surgical changes
- Soft tissue mass
- Vascular encasement
- Liver mass
- Pancreatitis

PET-CT:
- Post surgical changes
- Hypermetabolic mass
- Liver mass
- Pancreatitis
- Attenuation correction artefact
Identify the findings present on the following images:

**CT:**
- Post surgical changes
- Soft tissue mass
- Vascular encasement
- Liver mass
- Pancreatitis

**PET-CT:**
- Post surgical changes
- Hypermetabolic mass
- Liver mass
- Pancreatitis
- Attenuation correction artefact
Teaching points

• Post surgical changes with adjacent soft tissue attenuation is seen on CT.

• Findings suspicious for tumor recurrence.

• No FDG uptake on PET-CT at the site of soft tissue.

• **Merits of PET-CT**: Soft tissue attenuation at post surgical sites is common. CT can’t differentiate post surgical changes from tumor recurrence. Complete absence of FDG uptake excludes tumor recurrence.
Identify the findings present on the following images:

CT:
- Post surgical changes
- Mesenteric implants
- Bowel mass
- Osseous metastasis
- Ascites

PET-CT:
- Post surgical changes
- Mesenteric implants
- Bowel mass
- Osseous metastasis
- Ascites
Imaging findings

CT:
- Post surgical changes
- Mesenteric implants
- Bowel mass
- Osseous metastasis
- Ascites

PET-CT:
- Post surgical changes
- Mesenteric implants
- Bowel mass
- Osseous metastasis
- Ascites
Teaching points

- Mesenteric implants may be difficult to identify on CT.
- Differentiation from bowel loops may be difficult.
- Hypermetabolism on PET-CT allows for easy identification.
- **Merits of PET-CT**: Mesenteric implants are more readily identifiable due to their hypermetabolic nature. More accurate staging results from accurate identification of metastasis.
Identify the findings present on the following images:

**CT:**
- Solid pancreatic mass
- Cystic/necrotic pancreatic mass
- Vascular encasement
- Loco-regional nodal metastases
- Ductal dilatation
- Distant metastases

**PET-CT:**
- Solid pancreatic mass
- Cystic/necrotic pancreatic mass
- Hypermetabolic rim
- Vascular encasement
- Loco-regional nodal metastases
- Ductal dilatation
- Distant metastases
PET-CT:
- Solid pancreatic mass
- Cystic/necrotic pancreatic mass
- Vascular encasement
- Loco-regional nodal metastases
- Ductal dilatation
- Distant metastases

CT:
- Solid pancreatic mass
- Cystic/necrotic pancreatic mass
- Vascular encasement
- Loco-regional nodal metastases
- Ductal dilatation
- Distant metastases

Imaging findings
Which of the following will you include in the differential if this was a 20 year old female patient?

- Pancreatic adenocarcinoma
- Solid pseudopapillary epithelial neoplasm (SPEN)
- Pancreatoblastoma
- Complicated pancreatitis
- Mucinous neoplasm of the pancreas
- Islet cell tumor
- Lymphoma
Which of the following will you include in the differential if this was a 20 year old female patient?

- Pancreatic adenocarcinoma
- Mucinous neoplasm of the pancreas
- Solid pseudopapillary epithelial neoplasm (SPEN)
- Pancreatoblastoma
- Complicated pancreatitis
- Islet cell tumor
- Lymphoma
Teaching points

• Cystic pancreatic mass identified on both CT and PET-CT.

• Differential in this young patient includes SPEN, pancreatic blastoma, complicated pancreatitis and unlikely cystic pancreatic adenocarcinoma.

• Patient had biopsy-proven necrotizing pancreatitis.

• **Potential pitfall:** Inflammatory processes can mimic malignancy and cause false positive results.
Identify the findings present on the following images:

CT:
- Pancreatic mass
- Vascular encasement
- Ductal dilatation
- Lung mass
- Liver mass
- Serosal implant

PET-CT:
- Pancreatic mass
- Vascular encasement
- Ductal dilatation
- Lung mass
- Liver mass
- Serosal implants
<table>
<thead>
<tr>
<th>CT:</th>
<th>PET-CT:</th>
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<tbody>
<tr>
<td>Pancreatic mass</td>
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<tr>
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<td>Vascular encasement</td>
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<td>Ductal dilatation</td>
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<td>Lung mass</td>
<td>✔ Lung mass</td>
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<td>Liver mass</td>
<td>Liver mass</td>
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<tr>
<td>Serosal implant</td>
<td>Serosal implants</td>
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Teaching points

- No lung mass seen on CT.
- Hypermetabolic lung mass seen at right lung base.

**Pitfall of PET-CT**: Misregistration of hepatic activity leads to false impression of a lung nodule on PET-CT. Complete lack of corresponding CT abnormality should point to a possible misregistration artefact.

- Motion between CT and PET portions of the exam leads to misregistration artefact.
Identify the findings present on the following images:

**CT:**
- Post surgical changes
- Vascular encasement
- Ductal dilatation
- Liver mass
- Pancreatitis associated fluid collections

**PET-CT:**
- Pancreatic mass
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Identify the findings present on the following images:

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Teaching points

• Post surgical changes with metallic surgical clips/coils seen on CT.

• Hypermetabolic focus seen on PET-CT and attenuation corrected PET.

• No hypermetabolic mass present on non-attenuation corrected PET.

• **Pitfall of PET-CT:** Metallic surgical clips can lead to attenuation correction artefacts and lead to overestimation of FDG uptake on attenuation corrected images.

• Non-attenuation correction images should be closely scrutinized in post surgical areas and with lung and skin findings.
References


Thank you for viewing our presentation!

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