



UNIVERSITY of
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MEDICAL CENTER

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DEPARTMENT OF IMAGING SCIENCES

Imaging Sciences Interesting Cases

CASE 18

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CLINICAL PRESENTATION: The patient is an 84-year-old female who originally presented to her primary care physician with a new right-sided abdominal mass. She denied diarrhea, chest pain, shortness of breath, flushing, nausea, and vomiting. CT demonstrated small liver nodules and a 10 cm mass arising from the anterior aspect of the pancreatic head. A CT-guided biopsy specimen showed a neuroendocrine tumor. An Octreoscan was ordered to evaluate the extent of disease.

IMAGING FINDINGS:

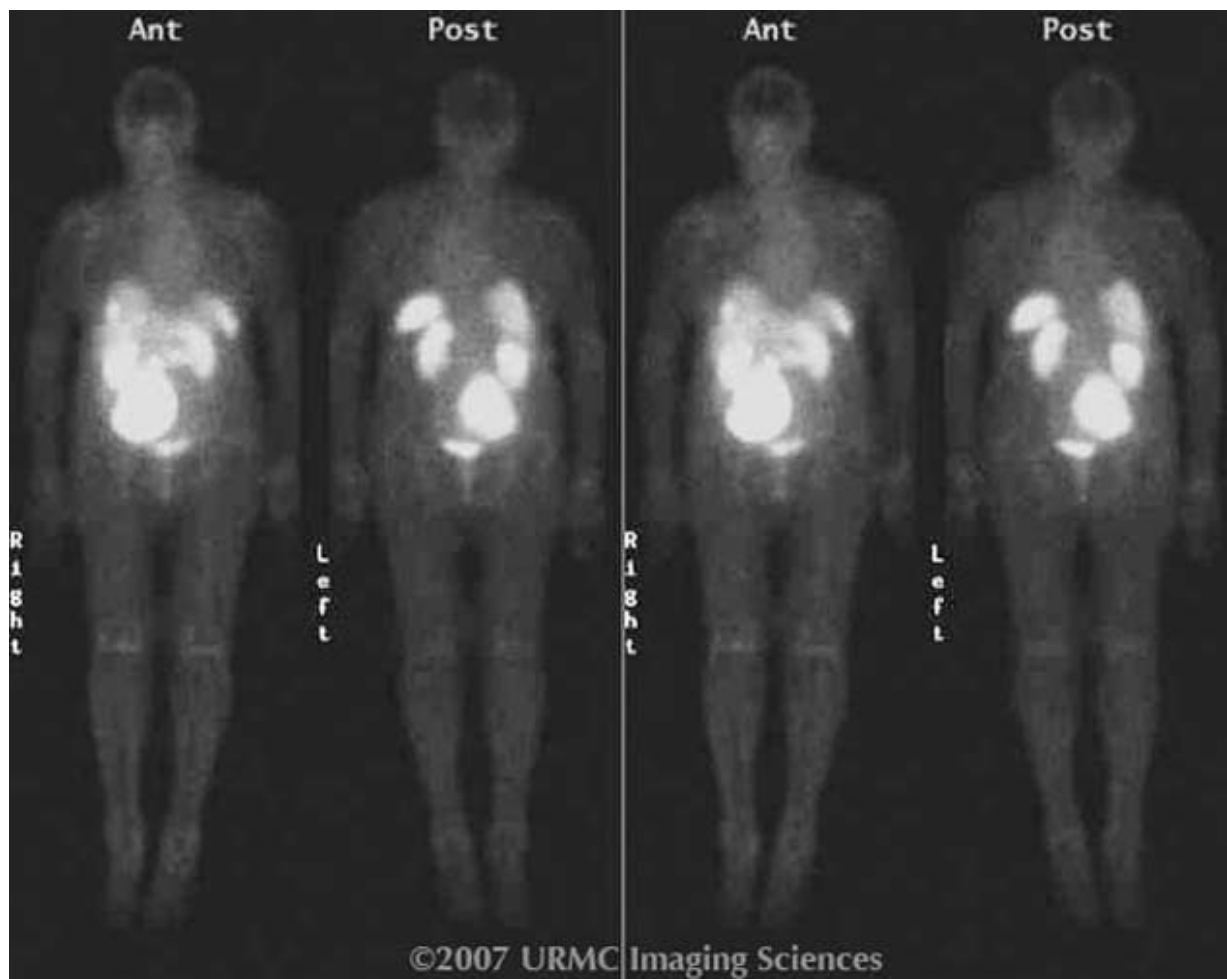


Figure 1: Five hour whole body images show heterogeneous activity in the liver and a large intense area of radiotracer uptake in the right abdomen. Physiological uptake is seen in the kidneys, spleen, bladder, bowel, and liver.

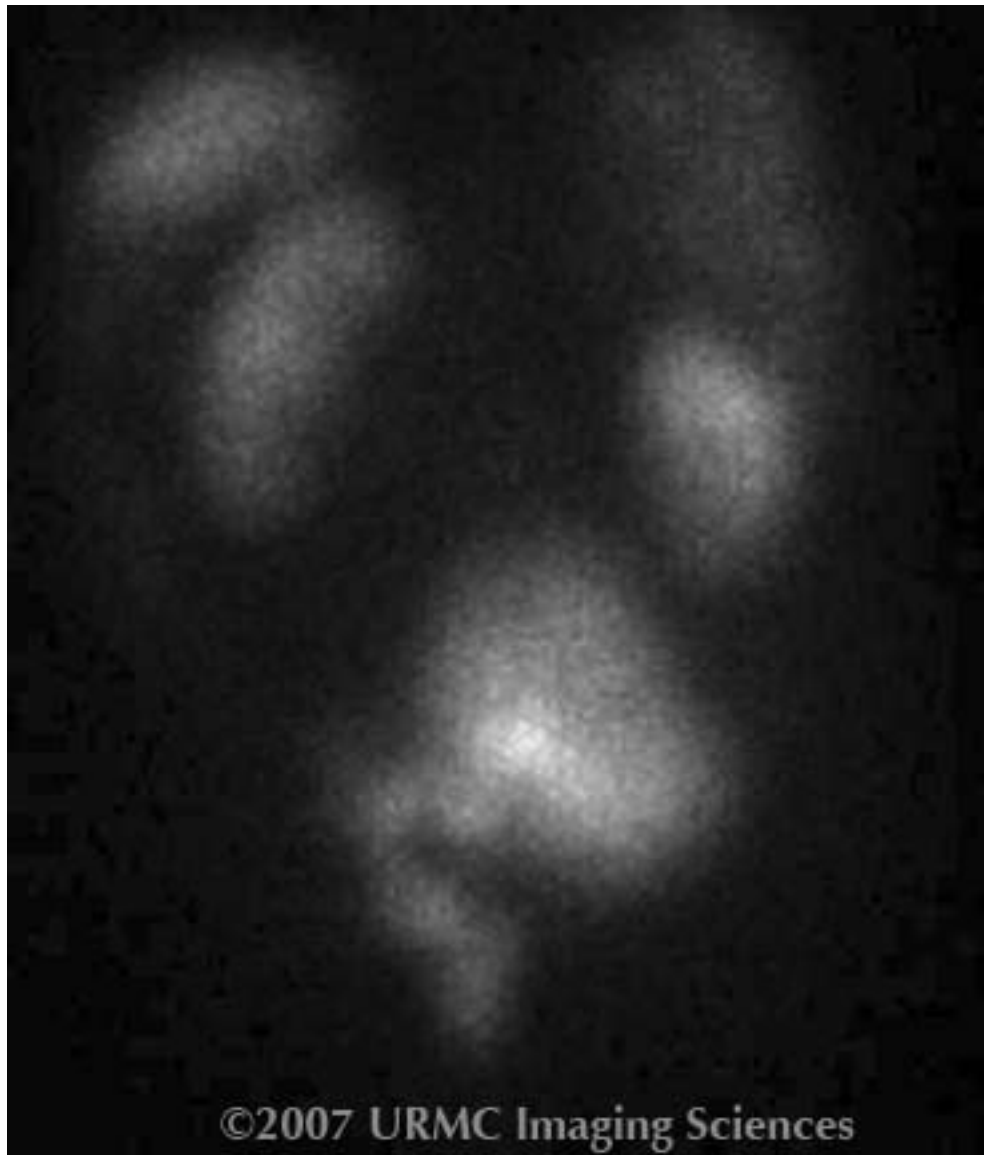


Figure 2: A 24-hour spot view of the posterior abdomen again shows intense activity in the right abdomen and physiological radiotracer uptake in the kidneys, spleen, liver, and bowel.

DIAGNOSIS: Somatostatin Receptor Positive Tumor in the right abdomen with multiple liver metastasis

DISCUSSION: Neuroendocrine tumors are derived from neural crest cells. They all share the ability to synthesize and produce peptide hormones and neurotransmitters. Examples of these tumors include: Amine precursor uptake and decarboxylation (APUD) tumors such as carcinoid, gastrinoma, insulinoma, pheochromocytoma; CNS tumors such as astrocytomas, meningiomas, and neuroblastomas; and others such as lymphoma, breast and lung cancer, and renal cell carcinoma.

Symptoms of neuroendocrine tumors may vary depending on the hormone being secreted. Carcinoid may cause flushing, diarrhea, nausea, and/or vomiting from vasoactive peptides. Dizziness, lethargy, tachycardia, and sweating caused from hypoglycemia and sympathetic responses are typical features of an insulinoma. Neuroendocrine tumors may also present as other endocrinopathies such as Zollinger-Ellison syndrome, Cushing Syndrome, and diabetes. Some patients may be asymptomatic if very little or no hormone is secreted, while others may have symptoms caused by mass effect from the sheer size of the tumor. Neuroendocrine tumors are often malignant. The primary site goes undetected for years and possibly decades during which the tumor can easily metastasize. The most common sites for metastasis are the

liver, lymph nodes, and bones.

Neuroendocrine tumors are typically classified histologically by the tissue of origin, biochemical behavior, and prognosis. However some tumors, especially poorly differentiated types, may not be identified with endocrine or serum markers. The tissue of origin may also be difficult to identify with widespread metastasis. The WHO classifies neuroendocrine tumors into five subclasses by cell characteristics ranging from less malignant to more malignant with added mixed and miscellaneous subtypes.

Somatostatin receptors are on many different neuroendocrine tumors. The peptide is normally made in the CNS and acts as a neurotransmitter. It also inhibits the release of growth hormone, gastrin, serotonin, and calcitonin outside the CNS. Octreotide is a somatostatin analog that can bind to the somatostatin receptor and is commonly used in the diagnosis and treatment of neuroendocrine tumors.

Octreotide radiolabeled with indium-111 (In-111 pentetreotide) is the preferred agent approved for imaging neuroendocrine tumors. Preceded by radioisotope iodine-123, In-111 offers a longer effective half life allowing for delayed imaging and reduced GI activity to help with abdominal tumor localization. SPECT imaging with In-111 pentetreotide allows further tumor localization. The sensitivity for many neuroendocrine tumors including carcinoid and gastrinoma is high. Two exceptions are insulinoma and medullary thyroid carcinoma. A disadvantage to In-111 pentetreotide is its high kidney activity, which makes interpretation of adjacent areas more difficult. Physiologic activity is seen in the kidneys, spleen, liver, and bowel.

Nuclear imaging specifically localizes primary and metastatic lesions. Localizing a single lesion is useful if attempts are going to be made at curative surgical resection. The detection of neuroendocrine tumors on scintigraphic scans also predicts a response to therapy as better visualized tumors tend to respond better to therapy.

Patients with suspected neuroendocrine tumor are also evaluated with CT, MRI, ultrasound, endoscopy, and/or various serum markers (serotonin, calcitonin, ACTH, Beta-HCG, gastrin, CCK, VIP, glucagon, insulin, NE, epinephrine, dopamine, pancreatic polypeptide etc). Nuclear imaging, as mentioned above, can be used to confirm the presence or evaluate for metastatic disease.

Symptoms are controlled with somatostatin analogues that act to slow hormone peptide production and may also cause neuroendocrine tumor regression with antiproliferative effects and inhibition of angiogenesis. Interferon is also used as therapy and stimulates T cell function to control hormone secretion. The effectiveness of the treatments improves when they are used in combination rather than individually. The use of chemotherapy or radiation depends on the tumor type.

REFERENCES:

1. Kaltsas GA, Besser GM, Grossman AB. The diagnosis and medical management of advanced neuroendocrine tumors. *Endocr Rev.* 2004 Jun;25(3):458-511. [PubMed]
2. Mettler FA Jr, Guiberteau MJ. Conventional Neoplasm Imaging and Radioimmunotherapy. In: *Essentials of Nuclear Medicine Imaging*. 5th Ed. Philadelphia, PA. Saunders Elsevier, 2006, pgs. 333-335.
3. http://en.wikipedia.org/wiki/Neuroendocrine_tumors