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LEARNING OBJECTIVES

1. Pictorial review of clinical features of major adrenal benign and malignant lesions characteristics in FDG PET/CT.
2. Tabular review of general guidelines for adrenal lesions to assist benign versus malignant determination.

INTRODUCTION

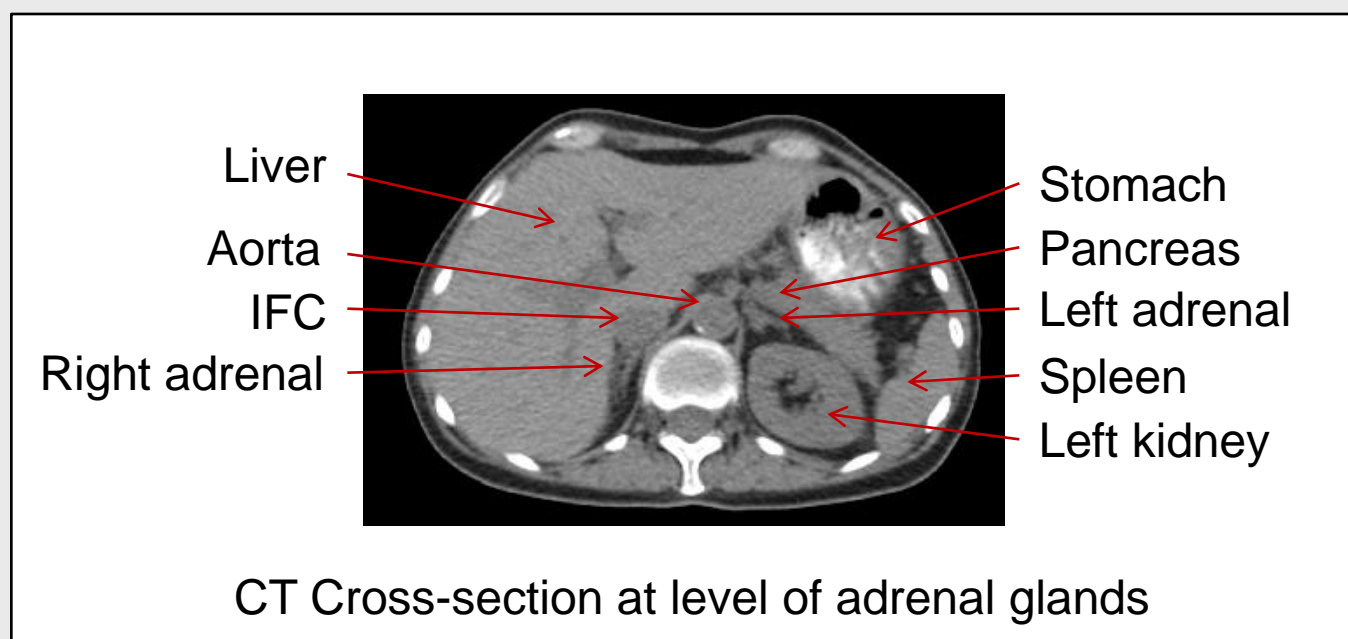
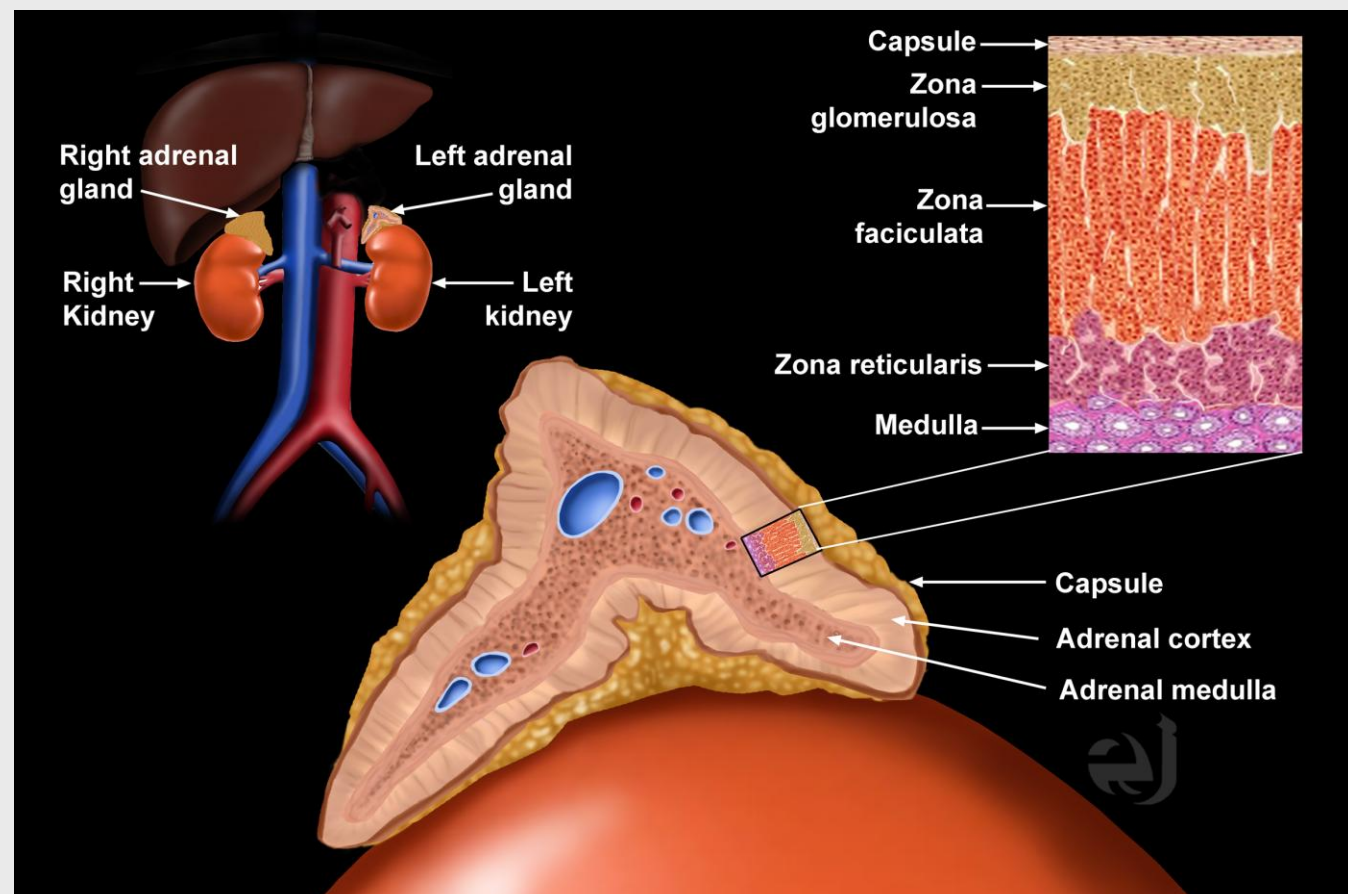
Between 2 – 7% of patients have incidental adrenal masses on imaging studies in the general population. Most of these incidental adrenal lesions are benign non-hyper functioning adenomas that require no treatment. On FDG PET/CT the incidence of malignant adrenal lesions increases due to common metastatic spread in lung cancer, breast cancer, renal cell carcinoma, neuroendocrine tumors and melanoma. Determining if adrenal lesions are benign or malignant can be paramount in directing cancer treatment to be curative or palliative. We selected FDG PET/CT cases with strong key representative findings to help illustrate benign and malignant adrenal lesions. Tabular review of PET SUV values, Hounsfield units and lesion size in the different cases will be discussed.

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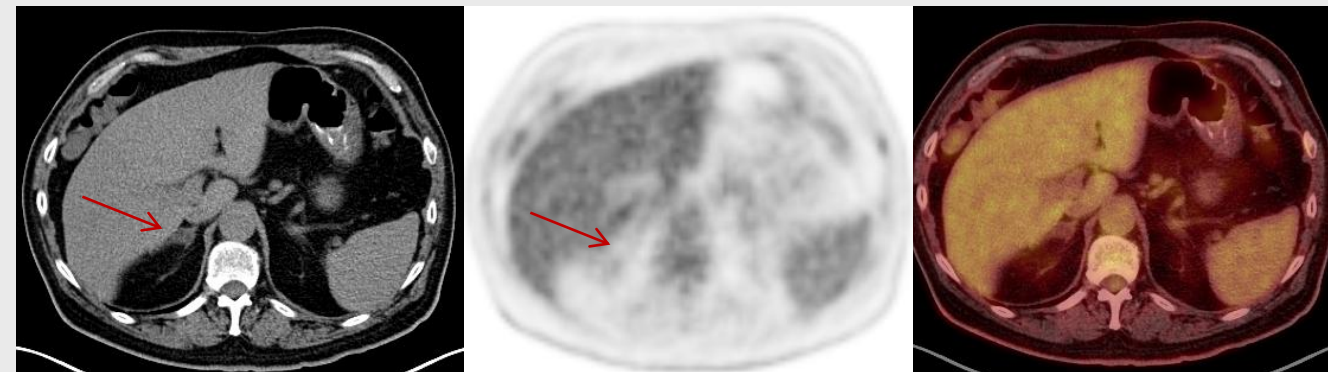
ADRENAL ANATOMY



CT Cross-section at level of adrenal glands

ADRENAL ADENOMA

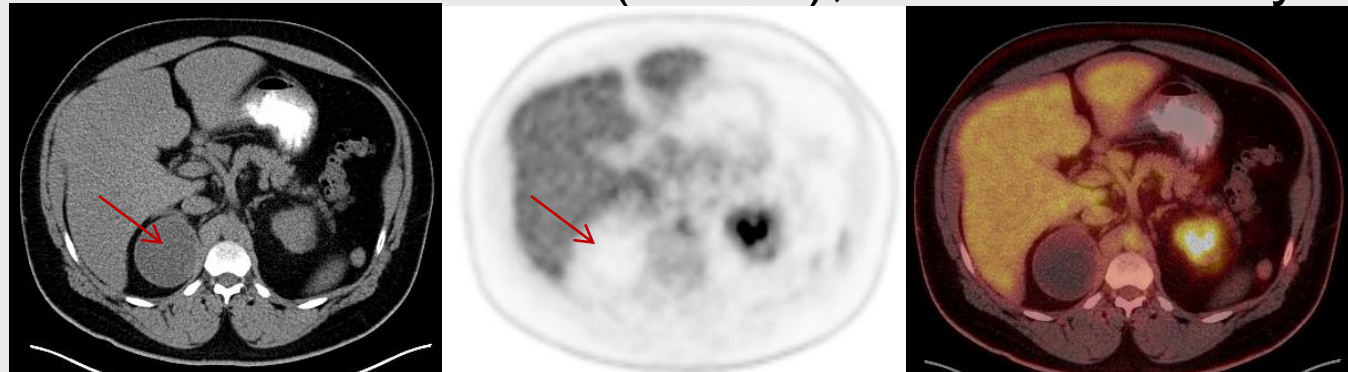
- Focal enlargement in the adrenal gland
- Contain varying degrees of adipose tissue
- Low or negative Hounsfield units (-20 to 30)
- FDG activity below liver



Adrenal adenoma with 0 Hounsfield, SUV below liver

ADRENAL CYST

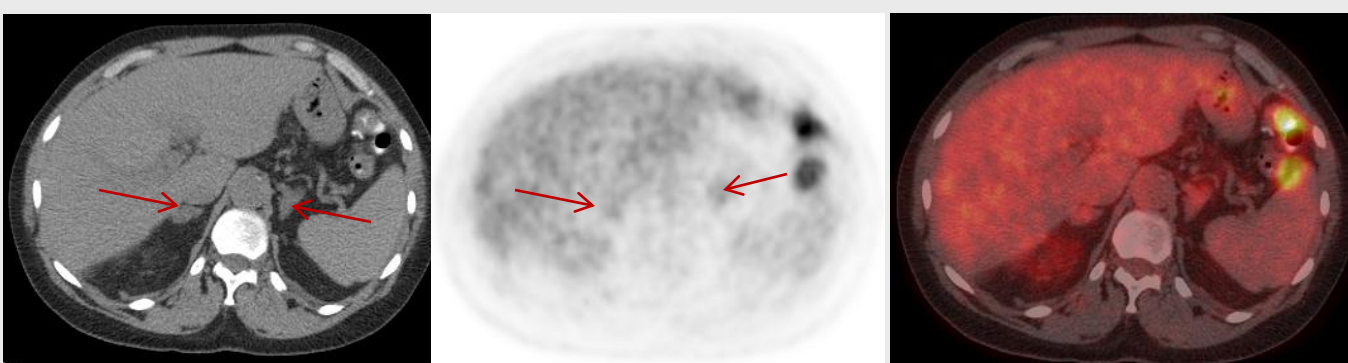
- Very rare 0.01% incidence
- Types (endothelial, epithelial, pseudocyst, parasitic)
- 40% cysts are pseudocyst can become malignant
- Hounsfield for fluid (0 – 15), no FDG activity



Adrenal fluid filled cyst with 15 Hounsfield and no FDG activity

ADRENAL HYPERPLASIA

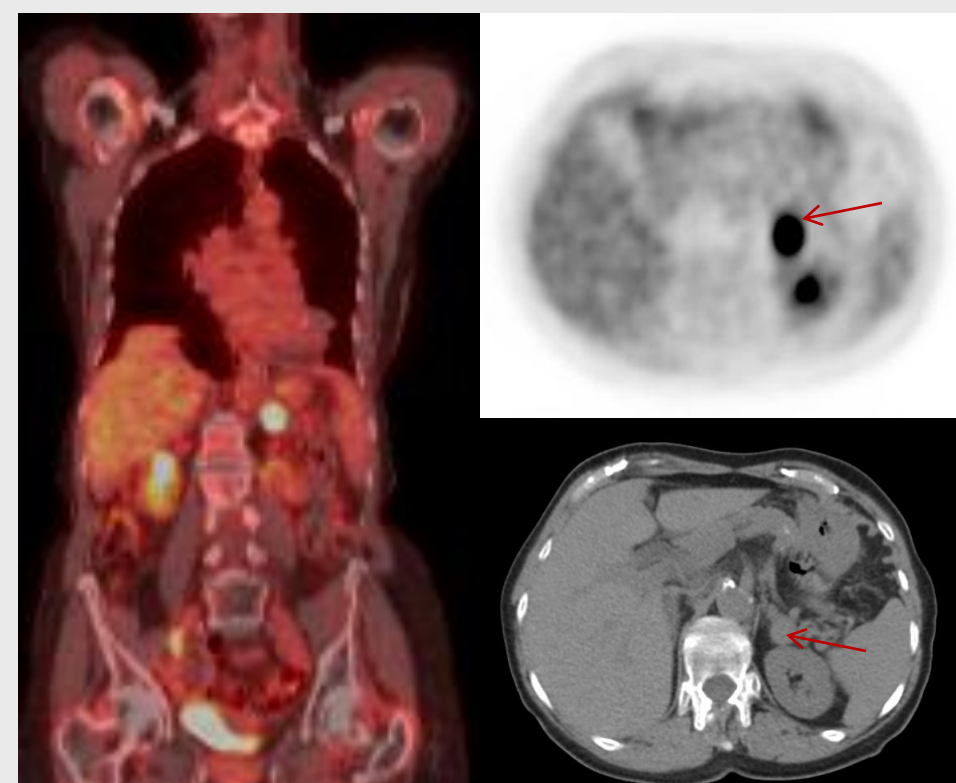
- Homogeneous diffusely enlarged glands
- SUV equal to or slightly higher than liver SUV
- Hounsfield units similar to a normal adrenal gland



Bilateral adrenal hyperplasia 8 Hounsfield, SUV 2.0 (liver SUV 2.9)

LYMPHOMA

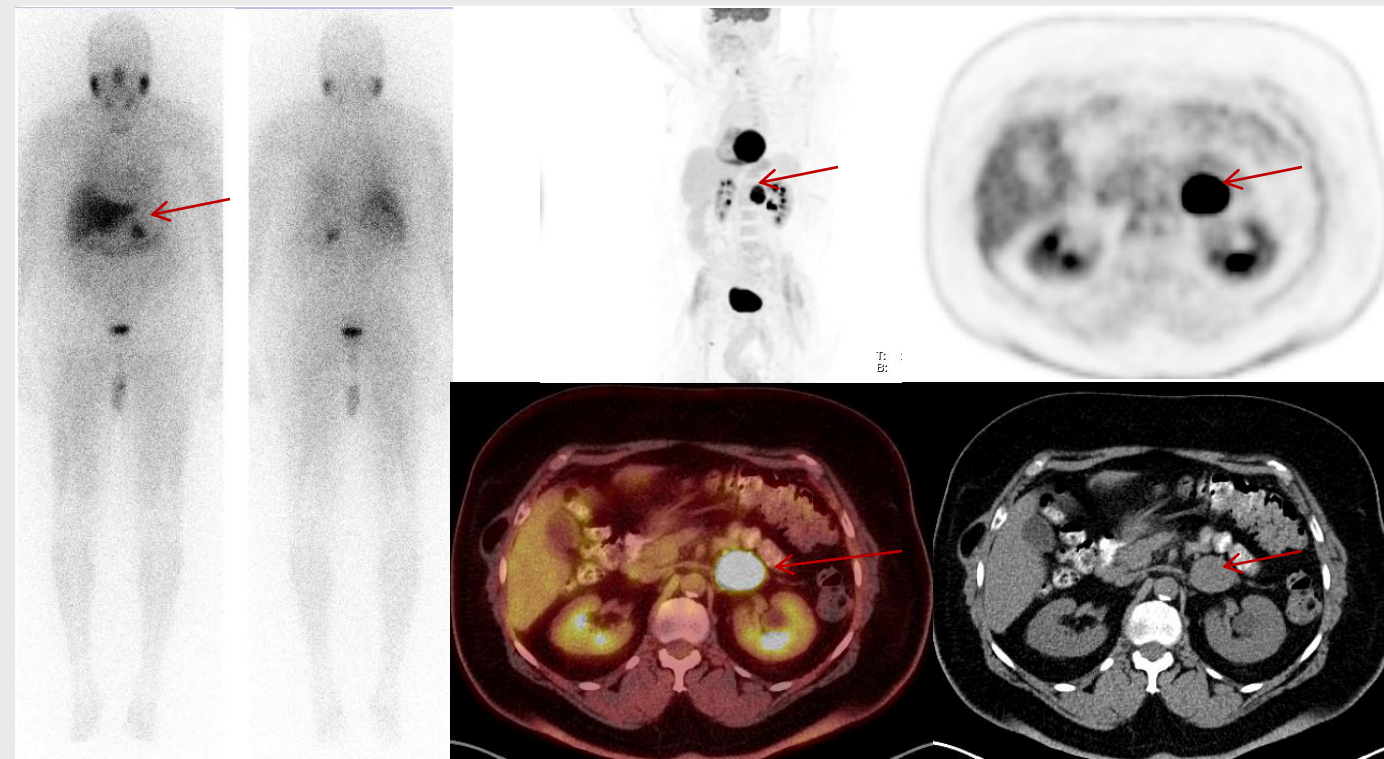
- Primary adrenal lymphoma is extremely rare
- Lymphoma involvement in adrenal glands is more common than primary adrenal lymphoma
- Intense FDG activity with high SUV
- Hounsfield units are not characteristic



Primary adrenal lymphoma

PHEOCHROMOCYTOMA

- Uncommon neoplasm that release catecholamine
- 85% of arise from adrenal medulla
- 0.1 – 0.3% hypertension caused by pheochromocytomas
- 90% occur sporadic, 10% endocrine syndromes
- FDG activity and Hounsfield variable

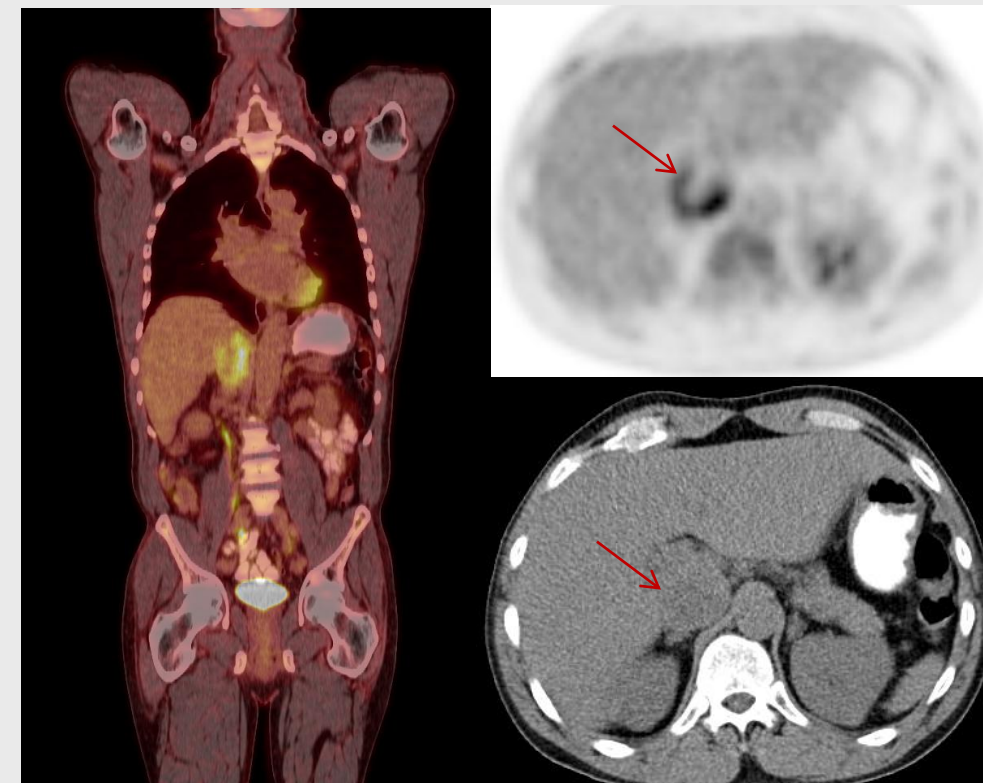


MIBG scan

Adrenal pheochromocytoma

LEIOMYOSARCOMA

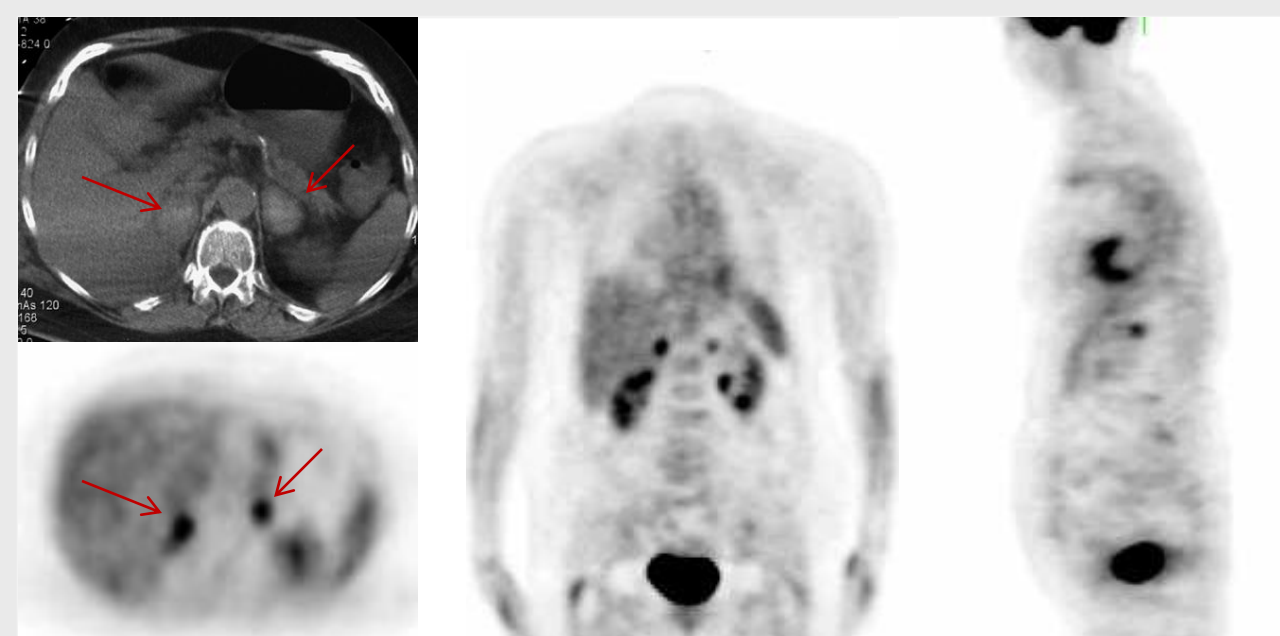
- Very rare malignant cancer of smooth muscle
- High SUV and Hounsfield not characteristic



Right adrenal leiomyosarcoma wrapping around the IVC with 6.2 SUV, size 6 cm

HIT SYNDROME

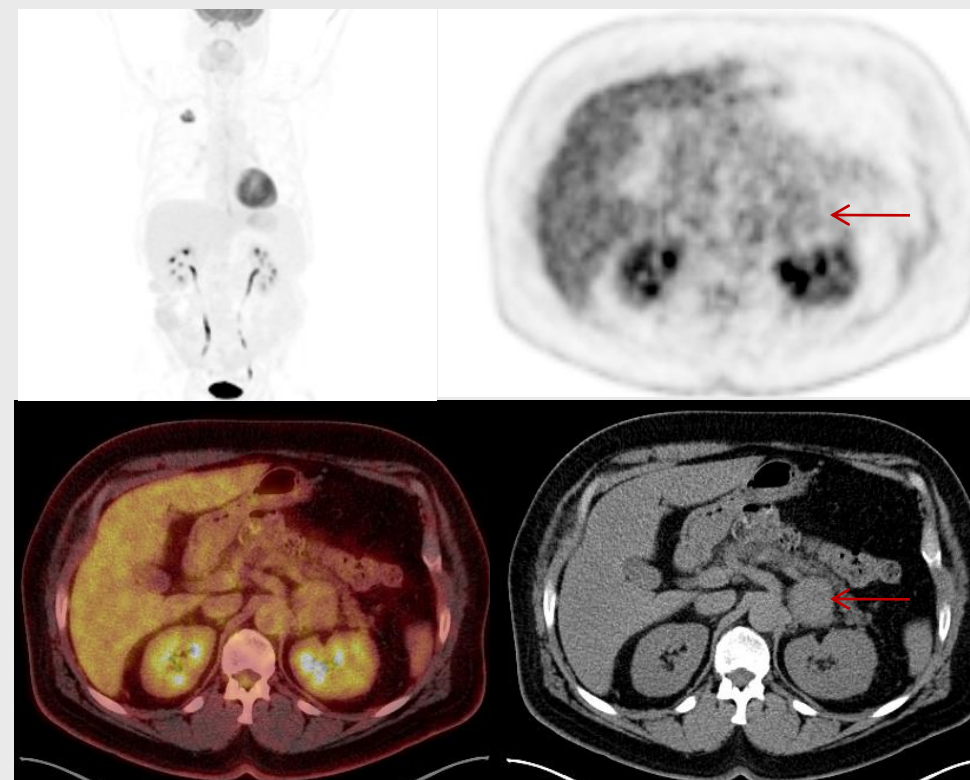
- Heparin Induced Thrombocytopenia is rare
- Can cause bilateral adrenal hemorrhage and insufficiency
- Hematoma/hemorrhage Hounsfield (50 – 90)



HIT with bilateral adrenal hemorrhage and intense SUV

MYELOLIPOMA

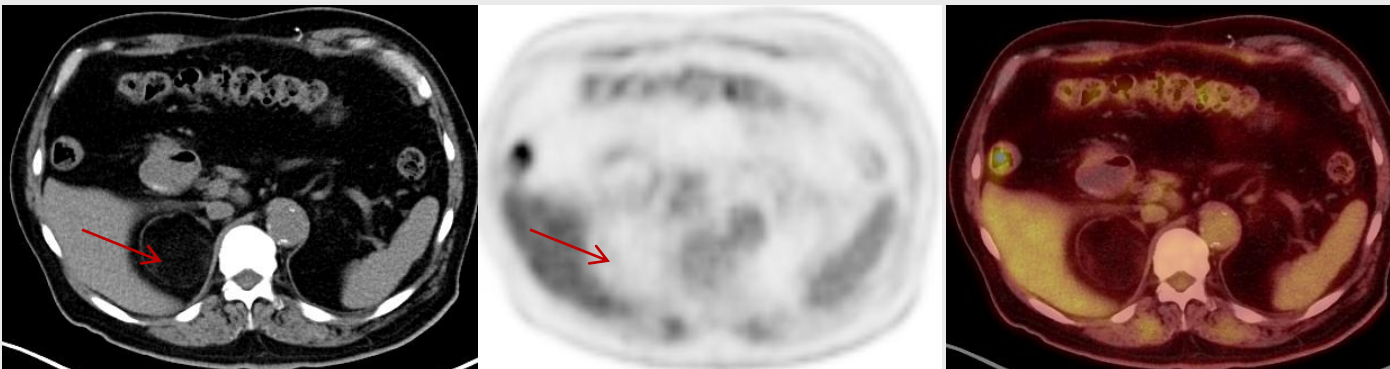
- Benign tumor composed of mature adipose tissue and hematopoietic elements
- Hounsfield units (-30 to -100)
- Incidence 0.1%, 3% of all adrenal tumors



Left adrenal myelolipoma

ADRENAL LIPOMA

- Composed of adipose tissue (HU -50 to -100)
- Usually has no significant FDG activity



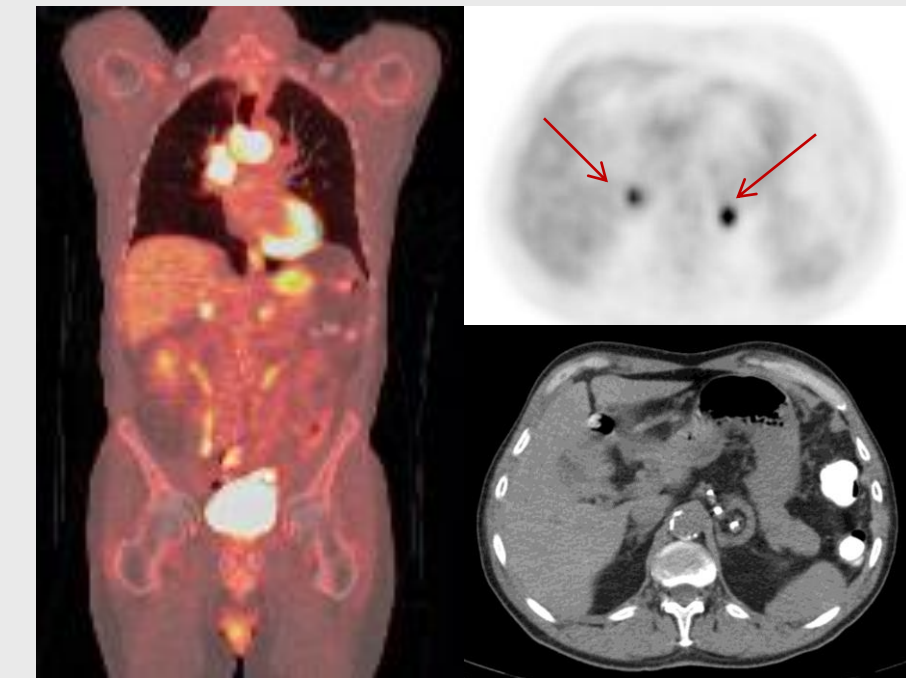
A 5 cm adrenal lipoma with - 62 Hounsfield and no FDG activity

METASTATIC

- Lung, breast, renal, ovary, lymphoma, leukemia and melanoma cancers are most common to metastasize to adrenals.
- 50% adrenal lesions in cancer patients are benign
- CT characteristics are highly variable

LUNG

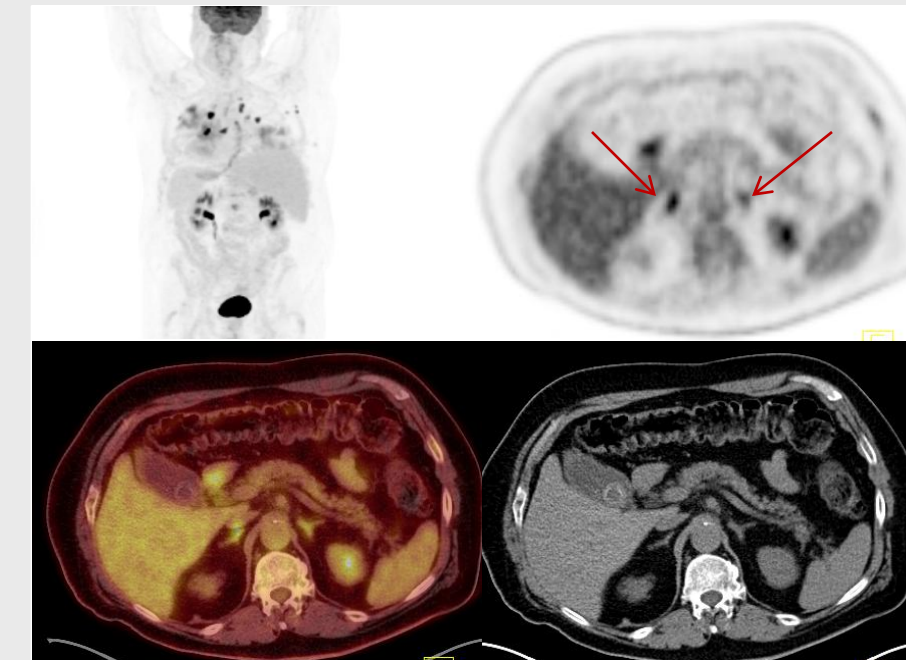
Adrenal metastasis occur 1.3% in lung cancer.



Bilateral adrenal metastases

BREAST

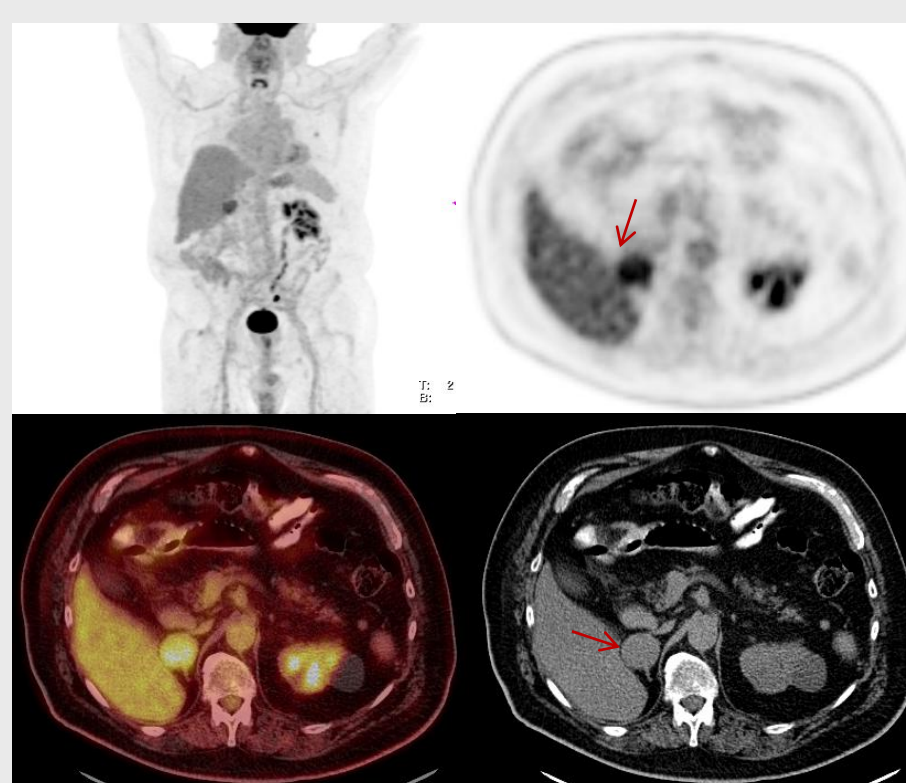
Metastasize to the lungs, liver, bones and brain, but rarely to the adrenal glands.



Bilateral adrenal metastases

RENAL

0.03% incidence and adrenal gland metastasis is typical site. Renal cancer SUV is variable.



Right adrenal metastasis s/p nephrectomy

GENERAL GUIDELINES

	Benign	Indeterminate	Malignant
Size	< 3 cm	3 cm < & < 6 cm	> 6 cm
Hounsfield	≤ 0	> 0	variable
SUV	Less liver	Equal liver	Greater liver
Shape	Round Smooth Uniform		Irregular Heterogeneous Poorly defined

CONCLUSION

Adrenal lesions on imaging studies are common in the general public and this incidence increases in PET/CT images secondary to the oncologic patient population and frequent adrenal metastases in many cancers. Having a strong knowledge of the different characteristics of adrenal lesions on PET/CT such as sizes, Hounsfield units and SUVs, can assist in determining benign versus malignant lesions and guide the course of treatment. However, many CT characteristics of malignant adrenal lesions are variable and the advent of PET/MR imaging may better characterize adrenal lesions. The take home caveat is that adrenal lesion guidelines are not hardened rules and close follow up imaging or tissue sampling should be incorporated if suspicion remains.

References available upon request.