

**THE ROLE OF PET/CT
(POSITRON EMISSION TOMOGRAPHY/
COMPUTED TOMOGRAPHY)
IN ASSESMENT OF ADRENAL MASSES**

Essay

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Contents

| Subjects | Page |
|--|-------------|
| Introduction..... | 1 |
| Aim of the work | 4 |
| Anatomy of Adrenal Gland | 5 |
| Pathology of Different Adrenal Masses | 29 |
| Technique of PET/CT | 44 |
| Clinical Manifestations and PET/CT Findings in Adrenal Masses | 66 |
| Summary and Conclusion | 118 |
| References..... | 123 |
| Arabic Summary | 132 |

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List of Abbreviations

ACTH AdrenoCorticoTrophic Hormone
BGO Bisthmus Germinate
FDG FluoroDeoxyGlucose

| | |
|--------------|--|
| FOV | Field Of View |
| LSO | Lutetium Oxyorthosilicate |
| MEN | Multiple Endocrine Neoplasia |
| NAI | Sodium Iodide |
| PET | Positron Emission Tomography |
| PET/CT | Positron Emission Tomography/ Computerized Tomography |
| PMT | Photomultiplier Tube |
| ROI | Region Of Interest |
| US | Ultrasonography |

List of tables

| | <u>Page</u> |
|--|-------------|
| Table 1: Normal adrenal gland size for age | - 25 - |
| Table 2: Common PET radioisotopes | - 49 - |

| | |
|---|--------|
| Table 3: Average adult PET and PET/CT scan times..... | - 56 - |
| Table 4: Acquisition Protocol Considerations in PET, CT, and PET/CT Whole-Body Imaging. | - 59 - |
| Table 5: Size, Density (HU), and SUV for All Masses and for Benign and Malignant adrenal masses separately. | - 62 - |
| Table 6: Evaluation of Adrenal Masses | - 67 - |
| Table 7: Comparison of the Size, CT Number, APLE, and SUV of Adenoma and Metastasis | - 85 - |

List of figures

| | <u>Page</u> |
|---|-------------|
| Figure 1: Normal anatomy: | 6 - |
| Figure 2; External appearance of adrenals | 7 - |
| Figure 3: Arterial supply of the adrenals. | 9 - |
| Figure 4: Venous drainage of the adrenal gland..... | 10 - |
| Figure 5: Section of a part of a suprarenal gland..... | 12 - |
| Figure 6: Human, Zenker's fluid, H & E., 22 x. | 13 - |
| Figure 7: Suprarenal glands viewed from the front..... | 15 - |
| Figure 8: Suprarenal glands viewed from behind..... | 16 - |
| Figure 9: Relations of the suprarenal glands | 18 - |
| Figure 10: NORMAL APPEARANCE | 21 - |
| Figure 11: Normal Adrenals Shown by CT..... | 22 - |
| Figure 12: Normal adrenal glands shown by MRI (T,-weighted). | 24 - |
| Figure 13: Normal Adrenal Gland Size as a Function of Age..... | 25 - |
| Figure 14: Gross specimen of a cortical adenoma of the adrenal (bright yellow glistening nodule attached to normal adrenal gland below). | 31 - |
| Figure 15: An adenoma made up of compact clear cells is seen on the left hand side, compressing residual, normal cortex on the righ..... | 32 - |
| Figure 16: This patient underwent left radical nephrectomy, adrenalectomy, distal pancreatectomy and splenectomy for adrenal cortical carcinoma. | 33 - |
| Figure 17: This patient presented with Cushing's syndrome and hypertension. CT scan revealed a 12.5 cm left adrenal mass. | 34 - |

List of figures (Cont.)

| | <u>Page</u> |
|---|-------------|
| Figure 18: This sharply circumscribed 3.5 cm pheochromocytoma presented in a 13 year old boy with von Hippel-Lindau disease..... | 36 - |
| Figure 19: The cells composing a pheochromocytoma are similar to the adrenal medulla chromaffin cells..... | 37 - |
| Figure 20: A 5.0 cm, well-circumscribed, firm, multinodular ganglioneuroma that arose in the adrenal | 39 - |
| Figure 21: This specimen represents a left adrenal mass removed from a 63 year old man 11 years after he underwent right radical nephrectomy for renal cell carcinoma..... | 40 - |
| Figure 22: It is a benign, tumor-like lesion consisting of mature adipose tissue with hematopoietic elements arising in the adrenal..... | 42 - |
| Figure 23: Positron–electron annihilation reaction | 47 - |
| Figure 24: Pictorial representation of (A) a true coincidence, (B) a scatter event, and (C) a random coincidence. | 49 - |
| Figure 25: Uptake of FDG. FDG is a glucose analog that is taken up by metabolically active cells by means of facilitated transport via glucose transporters (Glut) in the cell membrane. | 51 - |
| Figure 26: Normal PET study. From right-to-left, the rotating images are a useful way to survey lesions prior to reading the planar images on PET-CT..... | 52 - |
| Figure 27: Photograph (side view) of a hybrid PET-CT scanner shows the PET (P) and CT (C) components. | 57 - |
| Figure 28: Standard FDG-PET/CT imaging protocol. | 60 - |
| Figure 29: High-density metal artifacts, such as hip implants, cause streak artifacts on CT (A), which may translate into tracer uptake patterns on corrected PET images (B)..... | 65 - |
| Figure 30: 66-year-old woman with left adrenal adenoma..... | 72 - |
| Figure 31: 19-year-old woman with large right adrenal ganglioneuroma.. | 73 - |

List of figures (Cont.)

| | <u>Page</u> |
|---|-------------|
| Figure 32: 68-year-old woman with right adrenal metastasis from melanoma..... | 73 - |
| Figure 33: 37-year-old woman with left adrenal carcinoma. | 74 - |
| Figure 34: 51-year-old man with left adrenal carcinoma associated with multiple lung metastases. Whole-body FDG PET image shows abnormally increased tracer uptake in all tumor sites.... | 74 - |
| Figure 35: Lipid-rich adenoma in 74-year-old woman. | 76 - |
| Figure 36: Adenoma in 74-year-old man. Contrast-enhanced CT scan reveals 4-cm mass in right adrenal gland..... | 76 - |
| Figure 37: Metastasis from renal carcinoma in 31-yearold woman. Small, homogeneous left adrenal mass can be seen on this contrast-enhanced CT scan | 77 - |
| Figure 38: Carcinoma in 59-year-old man. | 78 - |
| Figure 39: Pheochromocytoma 5 x 3.5 cm in the left adrenal gland. | 79 - |
| Figure 40: Normal gastric uptake as a potential pitfall in PET interpretation..... | 81 - |
| Figure 41: Normal renal uptake as a potential pitfall in PET interpretation..... | 82 - |
| Figure 42: A 69-year-old man with a history of lung cancer. | 86 - |
| Figure 43: A 45-year-old man with a history of renal cell carcinoma..... | 87 - |
| Figure 44: Adrenal adenoma in a 63-year-old woman with a history of mucosa-associated lymphoid tissue lymphoma. | 90 - |
| Figure 45: Adrenal adenoma in a 60-year-old man with non–small cell lung cancer..... | 91 - |
| Figure 46: Myelolipoma in a 72-year-old woman with a history of metastatic endometrial carcinoma. Axial and coronal CT , PET and fused PET-CT images show a left adrenal mass | 93 - |

List of figures (Cont.)

| | <u>Page</u> |
|---|-------------|
| Figure 47: Metastatic disease in an 86-year-old man with metastatic melanoma and a history of prostate cancer..... | 95 - |
| Figure 48: Metastatic disease in a 62-year-old man with a history of melanoma..... | 95 - |
| Figure 49: Metastatic adrenal nodule from renal cell carcinoma in a 61-year-old man. | 96 - |
| Figure 50: Example of PET-positive adrenal mass in 64-year-old man with gastric carcinoma and 2.6-cm adrenal metastatic lesion..... | 97 - |
| Figure 51: Metastatic adrenal mass from lung adenocarcinoma in a 52-year-old man. | 98 - |
| Figure 52: Adrenal adenoma in a 50-year-old man with lung adenocarcinoma.. | 98 - |
| Figure 53: Lymphomatous adrenal gland involvement in a 23-year-old woman with Burkitt lymphoma of the left breast. Axial and coronal CT , PET and fused PET-CT images show a 2 x 1-cm mass in the right adrenal gland | 100 - |
| Figure 54: Collision tumors in a 46-year-old man with a history of high-grade leiomyosarcoma of the right spermatic cord. Axial and coronal unenhanced CT , PET and fused PET-CT images show a well-circumscribed 25-mm mass in the superior portion of the left adrenal gland..... | 102 - |
| Figure 55: Pheochromocytoma in a 42-year-old man with hypertension. The patient had a contraindication to MR imaging, and PET-CT was performed | 104 - |
| Figure 56: A right adrenocortical carcinoma in a 65-year-old woman was found in a routine health checkup and was confirmed by simultaneous measurements of late-afternoon serum cortisol and ACTH levels..... | 105 - |
| Figure 57: Nonneoplastic hypermetabolic activity..... | 108 - |

List of figures (Cont.)

| | <u>Page</u> |
|--|-------------|
| Figure 58: Adrenal adenoma. Fused PET-CT scan shows bilateral lesions in the adrenal glands | 110 - |
| Figure 59: False-negative adrenal nodule at integrated PET-CT performed in a 59-year-old man with lung adenocarcinoma with a predominantly bronchioloalveolar carcinoma component..... | 113 - |
| Figure 60: False-negative metastatic adrenal nodule at integrated PET-CT performed in a 55-year-old man with hepatocellular carcinoma..... | 113 - |
| Figure 61: False-negative metastatic adrenal nodule at integrated PET-CT performed in a 58-year-old man with lung carcinoma..... | 114 - |
| Figure 62: False-positive adrenal adenoma at integrated PET-CT performed in a 63-year-old woman with lung adenocarcinoma. | 116 - |
| Figure 63: Adrenal pheochromocytoma with increased FDG uptake at integrated PET-CT performed in a 33-year-old woman with multiple endocrine neoplasia type IIA. | 117 - |

INTRODUCTION

Since its introduction in 1998, dual-modality PET/CT imaging has received great attention in the medical community. For the first time, patients can be examined with both CT and PET in a single examination (*Beyer et al., 2004*).

PET/CT tomographs represent a hardware approach to image fusion by merging the components of commercially available PET and CT tomographs into a single gantry. Patients are scheduled for a single scan and receive 2 complementary examinations (PET and CT) whenever clinically indicated (*Beyer et al., 2006*).

PET/CT offers a unique hybrid imaging technique that combines the attenuation and morphologic detail of CT with the metabolic information from PET. These images can be fused to allow accurate coregistration of anatomic and functional data, and the combination of the two types of images leads to more assured anatomic localization of areas of increased metabolic activity (*Blake et al., 2006*).

Several advantages are associated with combined PET/CT imaging compared with retrospective or prospective software-based approaches to align complementary image data. Most important, the patient undergoing a combined PET/CT examinations is not moved physically (except for the translation

of the bed) between CT and PET acquisition, thus limiting misalignment from repositioning (*Beyer et al., 2004*).

Incidental adrenal masses are identified in approximately 5% of abdominal CT scans and in up to 8.7% of autopsies (*Boland et al., 1998*).

In patients without a known malignancy, most of these masses represent adrenal adenomas. Even in patients with a known malignancy, most of the masses are benign (*Mansmaun et al., 2004*).

The adrenal glands are a common site of metastatic disease. Even in a patient with a known malignancy other than an adrenal malignancy, however, an adrenal lesion is still more likely to be benign than to be malignant (*Blake et al., 2006*).

The issue of differentiation between benign and malignant adrenal lesions on CT has been the scope of many previous articles. The presence of intracytoplasmic lipid within adenomas has been found to accurately separate adenomas from malignant lesions (*Boland et al., 1998*).

Despite the high specificity of CT parameters enabling diagnosis of lipid-rich adenomas with a high degree of certainty, approximately 30% of adenomas are lipid poor, with higher attenuation values overlapping those of other adrenal masses, including malignancies (*Metser et al., 2006*).

With the advent of PET/CT imaging, the metabolic information obtained with fluorine 18 (^{18}F) fluorodeoxyglucose (FDG) PET can be combined with the morphologic information obtained with CT. With combined PET-CT, the superimposition of the precise structural findings provided by CT allows more accurate and reproducible correlation of a hypermetabolic focus seen at PET with the correct anatomic or pathologic equivalent (*Kapoor et al., 2004*).

There are PET-CT appearances of the major subtypes of adrenal disease, including benign neoplastic lesions, malignancy and benign mimics of neoplasia (e.g brown fat) (*Elaini et al., 2007*).

Although the fusion of the two independent data sets results in both a more comprehensive examination and more accurate localization of abnormalities, it also introduces some unique potential pitfalls and interpretative difficulties. Again, this situation is especially true in the abdomen and pelvis, where physiologic FDG uptake can be misleading and CT has tissue characterization limitations, especially following surgery (*Blake et al., 2006*).

AIM OF THE WORK

To illustrate common benign adrenal lesions at PET CT and the use of PET-CT in the differentiation of benign from malignant adrenal lesions.

ANATOMY OF ADRENAL GLAND

The adrenal glands are, despite their small size, among the most important and vital organs in the body. Their function was quite unknown until 1855, when Addison first described the syndrome resulting from their destruction. In 1856 Brown-Squard showed that their removal led to death in animals (*Sutton et al., 2002*).

DEVELOPMENT

The suprarenal (adrenal) cortex is formed during the second month by a proliferation of the coelomic epithelium (*Standring et al., 2008*).

The adrenal gland lies retroperitoneally above each kidney. They are each enclosed within the peri-renal fascia but in a separate compartment from the kidney. The adrenal gland has an outer cortex derived from mesoderm and an inner medulla which is derived from the neural crest and is related to the sympathetic nervous system (*Ryan et al., 2004*).

At birth the glands are comparatively larger and are approximately one-third the size of the ipsilateral kidney. The cortex of each gland reduces in size immediately after birth and the medulla grows comparatively little. By the end of the second month the weight of the suprarenal has reduced by 50%. The glands begin to grow by the end of the second year and