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

Essay

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List of Abbreviations

ACTH ..... AdrenoCorticoTrophic Hormone
BGO ..... Bisthmus Germinate
FDG ..... FluoroDeoxyGlucose

FOV.....Field Of View
LSO .....Lutetium Oxyorthesilicate
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

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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-Scquard 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