

**The Role of Dual Modality Positron Emission
Tomography/Computed Tomography (PET/CT) Imaging
In Diagnosis And Staging Of Breast Cancer**

Essay

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in

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**دور التصوير المدمج
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Introduction

Breast cancer is the second leading cause of cancer deaths in women today (after lung cancer) and is the most common cancer among women, excluding non melanoma skin cancers. According to the world health organization, more than 1.2 million people will be diagnosed with breast cancer each year worldwide. The American Cancer Society estimates that 178,480 new cases of invasive breast cancer will be diagnosed in 2007. Breast cancer death rates have been dropping steadily since 1990, according to the society, because of earlier detection and better treatments. About 40,910 breast cancer deaths are expected in 2007 (***www.imaginis.com, 2007***).

Breast cancer is often curable when diagnosed at early stages, so imaging plays very important role in disease detection and staging, there are many of modalities to image breast cancer including Mammography, Ultrasound, MRI (***Maryland, 2007***).

PET/CT is new imaging modality in oncology it has redefined as the gold standard for oncologic imaging (***David et al., 2005***).

PET/CT collect between the CT anatomical information and PET functional information leading to increase the ability

of early detection of cancer ,staging and follow up, therapy monitoring, detection of recurrence(*Blodgett et al.,2007*).

PET/CT added incremental diagnostic confidence to PET in more than 50% of Patients and regions with increased FDG uptake. PET/CT accurately detect more regions with malignancies than did CT. this initial evaluation suggest that PET/CT is preferable to PET or CT in the diagnosis of breast cancer (*Tatsumi et al., 2006*).

By combing the functional (physiological) image information derived from PET with the excellent anatomical detail provided by breast CT, we anticipate that amore quantitative assessment of breast cancer aggressiveness can be made, and the fused PET/ CT image data sets well provide physicians with better information to optimize the therapeutic Treatment of breast cancer on a patient-by-patient basis (**Ramsey, 2005**)

Form other obvious benefits of performing combined PET/CT over PET and CT done separately include consolidation of the patient imaging procedures, faster scan times, improved lesion localization, ability to use the technique for radiation therapy evaluation, planning(**James ,2005**).

The clinical application of PET and PET/CT in breast cancer will help to predict clinical behavior, and allow one to choose the appropriate treatment and to tailor local treatment



options to the individual patient. PET and PET/CT are also likely to play key roles in monitoring systemic therapy and evaluating the response to therapy at an earlier stage than conventional methods. In the future, PET may be applied with other tracers in addition to FDG, to improve characterization of tumor biology and more effectively measures response to therapy (*Delgado et al., 2005*).



AIM OF THE WORK

Study the role of dual modality Positron Emission Tomography/Computed Tomography(PET/CT) imaging in diagnosis and staging of breast cancer; early detection, follow up, monitoring of therapy leading to better prognostic results.

Anatomy of the breast

The breasts form a secondary sexual feature of females and are the source of nutrition for the neonate, Developmentally they are derived from modified sweat glands, predominantly composed(in the non-lactating breast) of adipose tissue surrounding epithelial secretory tissue arranged in 15-20 lobes, each leading to a lactiferous duct which converges with the others upon the nipple. Connective tissue, blood vessels, lymphatics and nerves also contribute to breast structure (***Peter et al., 1995***).

Each breast is a rounded eminence lying within the superficial fascia, chiefly anterior to the upper thorax but spreading laterally to a variable extent, In the adult female the base of the breast (its attached surface) extends vertically from the second to the sixth rib, and in the transverse plane, from the sternal edge , medially , almost to the midaxillary line laterally, the superolateral quadrant is prolonged towards the axilla along the inferolateral edge of pectoralis major, from which it projects a little, and may extend through the deep fascia up to the apex of the axilla(the axillary tail of Spence), the breast lies upon the deep pectoral fascia, which overlies pectoralis major and serratus anterior, and below, oblique

externus abdominis and its aponeurosis, particularly the upper outer quadrant, contains more glandular tissue than does the remainder of the breast (**Peter et al., 1995**).

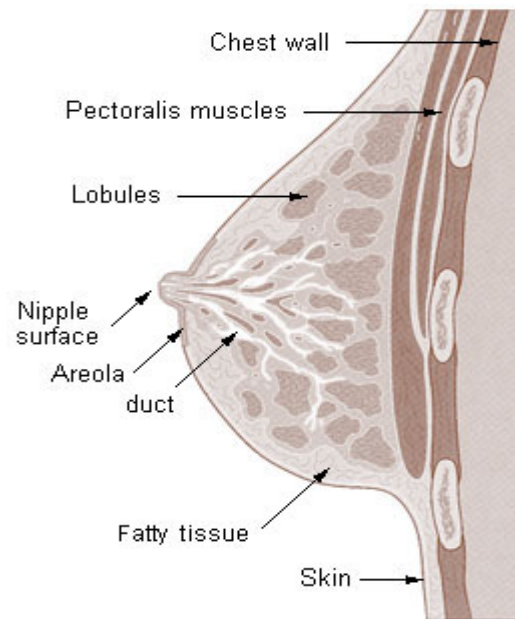


Fig: Anatomy of the female breast, (Quoted from <http://www.medicineworld.org>, 2008)

Between the breast and the deep pectoral fascia is loose connective tissue in the retromammary space "Submammary bursa, which allows the breast some degree of movement on the deep pectoral fascia, or on the thoracic wall, Breast shape and size widely varies depending upon genetic, racial, and dietary

factors, together with age, parity and menopausal status of individual (*Peter et al., 1995*).

NIPPLE:

The nipple projects centrally from the anterior aspect of the breast; its shape varies from conical to flattened or even retracted, depending on nervous, hormonal, developmental and other factors, also its level varies widely, it is covered by hairless skin; scattered sebaceous glands open on to its surface, Melanocytes are quite numerous, giving the skin of nipple a darker hue. Internally the nipple is composed mostly of collagenous dense connective tissue with numerous elastic fibres. Smooth muscle cells are also present disposed in a predominantly circular direction and radiating out from its base into the surrounding breast, their contraction causes erection of the nipple and wrinkling of surrounding area induced by cold or emotional stimuli. The lactiferous ducts traverse the nipple, their 15-20 minute orifices opens on to its wrinkled tip. Near its opening at the nipple each of these ducts is slightly expanded as a lactiferous sinus in the lactating breast by the presence of the milk (*Helen et al., 2006*).

AREOLA:

The areola is a discoidal area of the skin which encircles the base of the nipple; its colour also varies from pink to dark brown depending on parity and race, many sebaceous glands are present which enlarge in pregnancy and lactation as subcutaneous tubercles, there is no adipose tissue immediately beneath the skin of the areola and nipple (*Peter ET al., 1995*).

Accessory areolar glands (of Montgomery) are intermediate in their structure between the true mammary glands and sweat glands and produce small elevations on the surface of the areola (*Helen et al., 2006*).

INTERNAL ORGANIZATION OF THE BREAST:

The breast contains:

- Epithelial glandular tissue of the tubulo-alveolar type (alveolar, duct-lining and myoepithelial cells).
- Connective tissue cells (stroma) surrounding the glandular tissue (fibroblasts, lymphocytes, others including cells associated with vessels and nerves).
- Interlobar adipose tissue(*Peter et al.,1995*).