

**ROLE OF PET/CT IN STAGING AND TREATMENT MONITORING
IN CANCER BREAST**

ESSAY

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BY

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List of Abbreviations

AC/AL	Attenuation correction/Alignment
BGO	Bismuth Germinate
CT	Computed Tomography
DCIS	Ductal Carcinoma In Situ
ER	Estrogen Receptors
FDG	FluoroDeoxyGlucose
18FDG	¹⁸ F- FluoroDeoxyGlucose
18-F-FES	Fluorine-18 estradiol
GLUT	Glucose Transporters
GSO	Gadolinium Silicate
H ⁺	Hydrogen ion
IV	Intravenous
KeV	Kilo electron Volt
KV	Kilo Volt
LABC	Locally Advanced Breast Cancer
LCIS	Lobular Carcinoma In Situ
LSO	Lutetium Oxyorthosilicate
MCi	Micro Curies
MeV	Mega electron Volt
MRI	Magnetic Resonance Imaging
NOS	Not Otherwise Specified
NST	Neoadjuvant Systemic Therapy
PET	Positron Emission Tomography
PET/CT	Positron Emission Tomography/ Computed Tomography

PHA	Pulse Height Analyzer
PMTs	Photomultiplier Tubes
PR	Progestrone Receptors
SPECT	Single Photon Emission Computed tomography
SUV	Standardized uptake value
β^+	Positron
β^-	Electron
PSF	Point Spread Function

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Abstract

Currently, the clinical role of positron emission tomography (PET) and PET/computed tomography (CT) in patients with breast cancer is to provide additional information in select scenarios in which results of conventional imaging are indeterminate or of limited utility. There is currently no clinical role for fluorodeoxyglucose (FDG) PET in detection of breast cancer or evaluation of axillary lymph nodes, but these are areas of active research. FDG PET is complementary to conventional staging procedures and should not be a replacement for either bone scintigraphy or diagnostic CT. FDG PET and PET/CT have been shown to be particularly useful in the restaging of breast cancer, in evaluation of response to therapy, and as a problem-solving method when results of conventional imaging are equivocal. In these situations, FDG PET often demonstrates locoregional or unsuspected distant disease that affects management. PET has demonstrated a particular capability for evaluation of chemotherapy response in both patients with locally advanced breast carcinoma and those with metastatic disease

Keyword breast cancer - PET/CT

***INTRODUCTION
AND
AIM OF WORK***

Introduction

Cancer breast is a leading cause of death and the most common cancer in women, yet we still don't know how to prevent it. Early and accurate diagnosis remains a challenge. The current standard relies on physical examination, mammography and/or ultrasound, and fine needle aspiration. If breast cancer is found early, prompt treatment could save life (*Rohren et al, 2004*).

Although mammography is the most common performed method of screening the breast, other imaging modalities such as ultrasound, magnetic resonance imaging, computed tomography, and positron emission tomography (PET) may be used to provide additional information to better locate and define abnormal findings. Among these, PET, and more recently PET/CT fills certain imaging needs that other modes cannot meet (*Rohren et al, 2004*).

PET can show whether or not a lump in the breast is benign or malignant. PET may prove to be a very useful addition to mammography. For 70% of all women with suspicious mammograms, the expense and trauma of a breast biopsy for their final diagnosis may be unnecessary because of PET (*Tatsumi et al, 2006*).

PET accurately stages axillary and mammary lymph node involvement. Axillary lymph node dissection is currently a routine part of breast surgery. A complication of this procedure can be restricted movement of the arm, stiffness, swelling and pain. In the future, a PET

scan may make this procedure unnecessary for patients who show no lymph node involvement (*Radan et al, 2006*).

PET is the most useful test that you can have when doctors are staging or re-staging breast cancer because it is more accurate than any other test in finding local or distant disease. Although PET cannot see microscopic disease, it can detect clusters of tumor cells that have taken hold in other tissues or organs in the body (*Radan et al, 2006*).

Although PET is not commonly used to evaluate breast lesions at early stages, it is very useful for patients whose tumour markers in the blood are increasing, which may indicate recurrent disease. Rising cancer markers suggests the likelihood of a new tumour, but they do not tell where in the body a new tumour may be located. PET and PET/CT can be used in such situations to define the presence of a new tumour or confirm the location of a suspected tumour (*Piperkova et al, 2007*).

PET/CT as the name implies, combines two scanners PET which shows metabolism and the function of cells, and the CT which shows the detailed anatomy into one (*Tatsumi et al, 2006*).

In some cases, the combination of PET/CT can define lesion that would be impossible to clarify by PET or CT alone. For example, a mass appearing on a CT scan could be a tumour, or it could be fibrosis (scarring) from radiation and surgery. There is a non surgical way to identify which it is, short of monitoring over time to see whether it grows larger (which would indicate it is cancerous). Instead of waiting,

Introduction

the combined PET/CT provides a reliable indication of whether the mass is cancerous or not without exploratory surgery (*Bender et al, 1997*).

Aim of work

To review the role of PET/CT in detection, staging and follow up of breast cancer and its advantages over other modalities used before.

ANATOMY OF THE BREAST

Anatomical background

DEVELOPMENT:

The mammary line (crest, ridge) is an ectodermal (epidermal) thickening that appears during the 4th–5th week of development. It extends from axilla to groin, on each side of the body (Fig.1). Only a small portion of the line persists in the thoracic region. (*Sadler, 2004*).

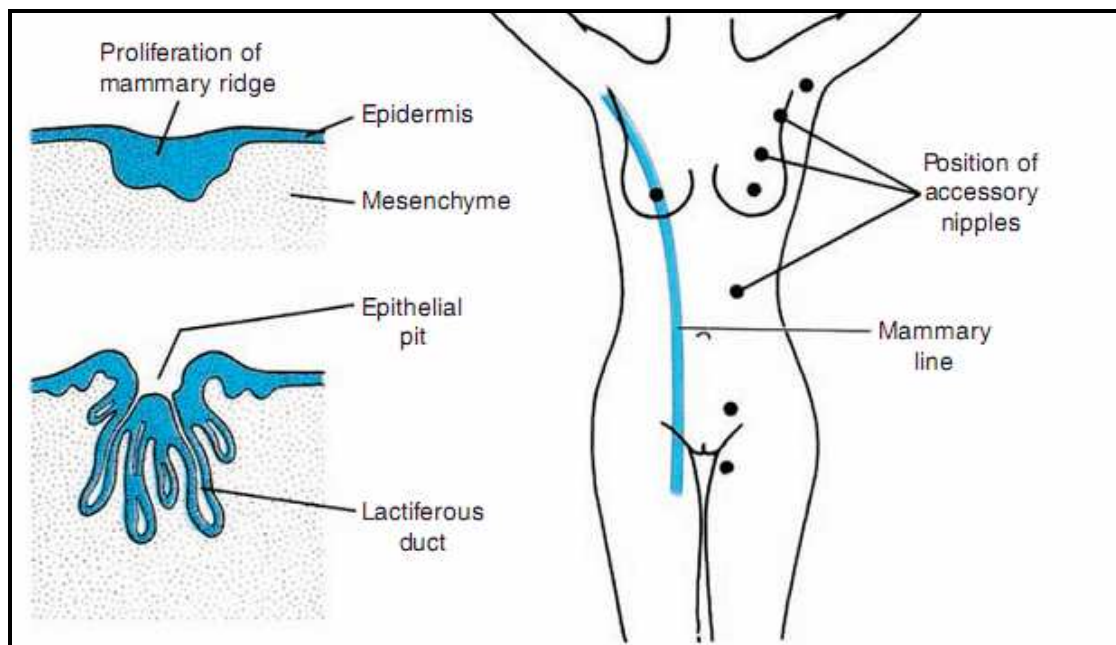


Fig.1.The position of the mammary line (*Sadler, 2004*).

Invasion of the underlying mesenchyme (dermis) in the 6th week gives rise to the mammary buds. These lengthen, branch and are canalised to form the lactiferous ducts. The lactiferous ducts come together in a depression on the surface of the skin called the mammary pit. Shortly after birth the pit is converted to the nipple (Fig.2) (*Moore and Persaud, 2003*).