Summary and Conclusion

Breast cancer is the most prominent cancer and the second most prominent cause of mortality in women. In recent years the incidence of breast cancer has increased to102 per 100,000 per year. Early diagnosis and follow-up of these patients are important for efficient patient management ***(www.Imaginis.com2007).***

Early detection is the most effective strategy for reducing mortality from breast cancer. At present, mammography is the only screening method that has been shown to affect patient survival ***(Maryland, et al., 2007).***

However, this technique has a low specificity, and about 10% of breast carcinomas cannot be identified by mammography even if palpable (>1cm in diameter).To overcome this limitation, other diagnostic techniques, such as computed tomography (CT), ultrasound (US), magnetic resonance (MR) & positron emission tomography (PET) are being used. The specificity of ultrasound is reported to be superior to that of mammography, especially in distinguishing solid and cystic lesions. MR imaging presents a sensitivity higher than 90%, but its specificity is lower than that of mammography. In conclusion, the combination of these examinations is not sufficiently conclusive to significantly reduce the use of invasive diagnostic procedures in the primary diagnosis of breast cancer***(Dose et al., 2002).***

PET with 2-[fluorine-18] fluoro-2-deoxy-D-glucose (FDG) has been recognized as a useful diagnostic technique in cancer imaging ***(yang et al., 2007).***

In patients with breast cancer, PET has been used for diagnosis, staging, monitoring response to therapy, restaging patients with breast cancer ***(Iagaru et al., 2007)***.

A major advantage of FDG PET imaging compared with conventional imaging is that it screens the entire patient for local recurrence, lymph node metastases and distant metastases during a single whole body examination using a single injection of activity, with a reported average sensitivity and specificity of 96% and 77%, respectively. In most studies the sensitivity of FDG PET is higher than that of a combination of conventional imaging methods ***(Grahek et al., 2007).***

Despite its high sensitivity for the detection of malignant diseases, PET is occasionally not able to differentiate increased but physiologic uptake from malignant lesion and the capability of PET to depict lesions smaller than 1cm in diameter is constrained by limited spatial resolution ***(Yefremov et al., 2003).***

Limitations of FDG PET in the follow-up of breast cancer patients include the relatively low detection rate of bone metastases, especially in case of the sclerotic subtype, and the relatively high rate of false positive results ***(Cook et al., 2007)***.

Conventional imaging modalities such as mammography and US rely primarily on changes in anatomic structure for disease detection. FDG PET can help detect accelerated metabolic activity that occurs before anatomic structural changes; however, because of the expense of the

examination and the radiation exposure involved, it is not generally suitable for routine screening purposes ***(Lim et al.,2007)***.

The combination of metabolic and morphological imaging within the same patient position following image fusion should be advantageous in terms of exact localization of lesions and, in turn, reduction in interpretative pitfalls ***(Iagaru et al., 2007).***

PET/CT is a unique combination of the cross sectional anatomy provided by CT and the metabolic information provided by PET which are acquired during a single examination ***(Kapoor et al., 2004)***.

Synergistic advantage of adding CT is that the attenuation correction needed for PET can also be derived from the CT data, an advantage not obtainable by integrating PET and magnetic resonance imaging. This makes PET/CT 25%-30% faster than PET alone with standard attenuation-correction methods, leading to higher patient throughput and a more comfortable examination ***(Messa et al., 2004).***

PET/CT added incremental diagnostic confidence to PET in 60% of patients and in more than 50% of regions with increased FDG uptake. PET/CT correctly detected more regions with malignancies than did CT, and 28% of the malignant regions with positive PET/CT findings showed equivocal or negative CT findings ***(Tatsumi et al., 2006)***.

There is less confusion over nonmalignant sites of FDG accumulation, such as inflammatory foci, variable physiologic uptake in assorted tissues, and brown fat or muscle uptake, because these foci can be more precisely localized to nonmalignant structures. In addition, PET/CT offers

improved localization of malignant lesions, including improved staging (especially for extranodal disease), better follow-up of sentinel lesions, improved targeting of biopsy and therapy, and greater confidence in interpretation. PET/CT also improves the detection of non–FDG-avid tumors that would not be evident on a PET study alone ***(Bakheet et al., 2000)***.

The added value of FDG PET/CT over other diagnostic modalities lies in the fact that it allows noninvasive evaluation and accurate cancer staging throughout the body in a single examination. PET/CT is useful for accurately determining the anatomic locations of areas of increased uptake, a difficult task with PET alone ***(Fueger et al., 2005)***.

Positron emission tomography combined with computed tomography (PET/CT) has been receiving increasing attention during the recent years for making the diagnosis, for determining the staging and for the follow-up of various malignancies ***(Bolton et al., 2005)***.

PET/CT was found to be significantly more accurate than PET alone and CT alone for the staging of visceral and non visceral metastases ***(Eubank et al., 2004)***.

PET/CT detects unexpected metastasis at the initial diagnosis and accordingly changes patient management ***(Yao et al., 2007)***.

The major roles for PET/CT in breast cancer are in the staging, detecting and localizing metastasis, monitoring the therapeutic response to treatment and early detection of recurrence ***(Yang et al., 2007)***.

First results using PET/CT imaging in the follow-up of breast cancer patients demonstrate increased specificity compared with FDG PET alone. Both imaging modalities, however, offer to detect recurrent and metastatic breast cancer disease at an early stage and thus continue to demonstrate the efficacy of molecular imaging in patient management, despite the limited therapeutic options in recurrent and metastatic breast cancer ***(Tatsumi et al., 2006)***.

In primary tumor, FDG PET/CT is of limited use in patients with early-stage disease without nodal or distant metastases, it has poor detection rate for small breast carcinomas ***(Yang et al., 2007)***.

However, in patients with palpable regional lymphadenopathy, PET/CT scanners have the same sensitivity as (SLN) in detection of metastasis with over advantage of detecting occult metastasis and provide accurately aligned anatomical and functional images of a patient, allowing functional abnormalities to be localized and distinguished from normal uptake of the PET tracer, which increases Physician confidence in arriving at a correct diagnosis ***(Ueda et al., 2008)***.

FDG PET and PET/CT have been shown to be most helpful in staging recurrent or metastatic breast cancer and in evaluating the response of locally advanced and metastatic breast cancer to treatment. Emerging data support the use of FDG PET/CT in advanced axillary disease and evaluation of regional nodal spread in LABC ***(Lim et al., 2007)***.

Integrated FDG-PET/CT is a sensitive and accurate imaging modality, superior to CT for diagnosis of tumor recurrence and for definition of extent of disease in patients with breast cancer and rising tumor markers.

PET/CT appears to have a role in determining the subsequent clinical management of these patients ***(Radan et al., 2006)***.

Currently, only FDG and occasionally fluoride PET are used in clinical practice (imaging of the breast). It is likely that future studies will benefit from tracers other than FDG, for example 18F fluorestradiol to image estrogen receptor expression, to image a much wider range of tumor biologic features ***(Diane et al., 2006)***.

In conclusion PET/CT is the latest innovation in oncology imaging, but is in reality, just the combination of the cross sectional anatomy provided by CT and the metabolic information provided by PET which are acquired during a single examination so fused PET/CT is superior to both PET alone and CT alone and has the ability to detecting and localizing distant metastasis with high accuracy in patient of breast cancer , increases the number of patients with correctly staged breast cancer, has the ability to differentiate between recurrence, residual, operative scar and post irradiation fibrosis and also has a positive effect on treatment planning with a profound effect on evaluation of therapy so it is more accurate in patient follow up, leading to better patient prognosis ***(Lim et al., 2007)***.