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Positron emission tomography imaging in breast cancer: a pictorial essay

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Learning Objective: We offer a pictorial essay illustrating the clinical applications of Fluorodeoxyglucose Positron Emission Tomography/Computed Tomography (FDG PET/CT) imaging in the staging and response assessment of breast cancer.

Background: Imaging plays a key role in the diagnosis and management of Breast Cancer. Commonly, this involves Mammography for diagnosis, followed by Computed Tomography and Scintigraphic Bone Scan for staging and monitoring.

The advent of FDG PET imaging has revolutionised the practice of oncologic imaging by conferring the additional dimension of metabolic imaging to the precision of structural imaging achieved by modern day modalities of Computed Tomography and Magnetic Resonance Imaging scans.

Its use has rapidly expanded, especially so in the field of oncology, where whole body imaging for the purposes of diagnosis, staging and monitoring is essential in management. High spatial resolution and superior sensitivity and specificity when combined with CT imaging makes it an invaluable tool in clinical practice.

Details: We present a series of images on the use of FDG PET/CT hybrid imaging in the staging of patients with histologically proven breast carcinoma, based on the AJCC TNM classification criteria for breast cancer, as well as the use of FDG PET/CT in post therapy assessment.

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POSTER SESSION

Screening

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Does full-field digital mammography in a decentralized breast cancer screening program lead to comparable screening performance parameters as film-screen mammography?

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Background: Several studies confirmed that screening with full-field digital mammography (FFDM) is not inferior to film-screen mammography (FSM). Most of these studies have been performed in a centralized screening organization. However, in some countries a decentralized organization is used. In a decentralized organization, the first reading takes place in the local unit while the second reading can be organized in a central breast unit (CBU). The purpose of this study is to compare the screening performance parameters of FFDM with the parameters of FSM in the framework of a decentralized national screening organization.

Materials and Methods: A nationwide decentralized screening program was launched in 2001 and since April 2005 screening with FFDM has been allowed. The program offers a biennial mammography screening to women aged between 50 and 69 years. The national quality assurance manual for the physical-technical evaluation strictly adheres to the European Guidelines. Firstly, the screening performance parameters of the three regional-screening-units (RSUs) that first switched to FFDM (11,355 women) were compared to the parameters of the FSM period of the same three RSUs (23,325 women). Secondly, they were compared to the screening performance parameters of the whole central breast unit, including 147,690 women.

Results: For the first control group: the Recall Rate (RR) of the FFDM group in the initial round was 2.64% (for FSM 2.40% ($p = 0.43$)) and the subsequent round 1.20% (for FSM 1.58% ($p = 0.03$)). The overall Cancer Detection Rate (CDR) was 0.59% for FFDM and 0.64% for the FSM group ($p = 0.56$), which corresponds to 0.63% in the initial round and 0.57% in the subsequent round for the FFDM group and 0.60% in the initial round and 0.72% in the subsequent round for the FSM group. The percentage of Ductal Carcinoma in Situ (DCIS) was 0.07% in the FFDM group and 0.16% in the FSM group ($p = 0.02$). The Positive Predictive Value (PPV) was 34.9% in the FFDM group and 30.67% in the FSM group ($p = 0.09$), with a high PPV in the subsequent round (48.00% for FFDM vs. 45.93% for FSM) and lower in het initial round (24.05% for FFDM vs. 24.86% for FSM).

Comparing the results of FFDM with the whole CBU (second control group): the RR of the CBU in the initial round was 2.75% ($p = 0.70$) and in the subsequent round 1.14% ($p = 0.66$); the CDR of the CBU in the initial round was 0.69% ($p = 0.68$) and in the subsequent round 0.47% ($p = 0.19$); the PPV in the initial round was 25.29% ($p = 0.80$) and in the subsequent round 41.29% ($p = 0.18$). Over the period 2001 to 2008, DCIS varied between 0.8/1000 and 1.8/1000 in the inital round and 0.6/1000 and 1.1/1000 in the subsequent round.

Conclusion: This is the first report on a decentralized screening organization where FFDM is implemented successfully with a high CDR and without an increase of RR.

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Mammography screening and radiation-induced breast cancer among women with a familial or genetic predisposition: a meta-analysis

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Background: Women with familial or genetic aggregation of breast cancer are often offered breast cancer screening outside the population screening program, due to their high breast cancer risk and possibly young age of onset. However, the benefit of early tumour detection by mammography screening could be reduced by the risk of radiation-induced tumours. A meta-analysis on epidemiological studies was conducted and addressed the question how low-dose radiation exposure, such as mammography screening and chest x-rays, affects breast cancer risk among high-risk women.

Materials and Methods: A systematic search was conducted in Pubmed and EMBASE/Medline. The search strategy "Breast neoplasms AND Mass screening/adverse effects OR Mammography/adverse effects OR neoplasms, radiation-induced" was combined with text words focusing on high-risk women. Pooled odds ratios (OR) were calculated.

Results: In total, 104 articles were found, of which 53 were relevant for screening by two independent reviewers. Finally, 6 studies were selected. Four studies examined the effect of exposure to low-dose radiation among mutation carriers. Two studies researched the effect of radiation among women with a family history of breast cancer. Pooled OR revealed an increased risk of breast cancer among high-risk women due to low-dose radiation exposure (OR = 1.5, 95% CI: 0.9−2.4). Exposure before the age of 20 (OR = 2.5, 95% CI: 1.9−3.2) or five or more exposures were associated with a significantly higher radiation-induced breast cancer risk (OR = 2.5, 95% CI: 1.6−3.9).

Conclusion: Low-dose radiation increases breast cancer risk among young women with a familial or genetic predisposition. A careful approach is advised when using low-dose radiation among high-risk women, and repeated exposures and exposure at young age should be avoided.

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Barriers affecting uptake of breast cancer screening in women of rural India and their impact on the disease: experience from the breast cancer screening services of a teaching hospital

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Background: In developing countries like India majority of rural population is deprived of availability of health resources and awareness programmes. This study was conducted to prospectively evaluate factors which act as barriers to uptake of breast screening in rural north Indian women and to study its impact on clinical consequence of the disease. It was also conducted to provide an insight to the health planners into devising targeted strategies.

Patients and Methods: Non compliant/deprived rural areas were identified. Regular community based educational programmes were conducted (2006–2009) which included distribution of multilingual information pamphlets and literature, invitation from the doctor for free screening with free transportation facilities and viewing of well illustrated screening audiovisuals. Every round was followed by filling of multilingual questionnaires to know the perceptions of screening practices of females by social workers trained according to ethnic and sociocultural beliefs of the targeted population.

Results: Of the 18 community based programmes carried out (2006−09) 886 completed the questionnaire and its factor analysis revealed: limited knowledge/lack of education (n = 250), Limited funds (n = 200), Difficulty in accessing facilities (n = 135), family priorities (n = 122), unhelpful attitude of health workers (n = 103), religious/spiritual delays (n = 76). Out of 886 females who completed the questionnaire, 421 attended the breast screening service giving an uptake of 50% compared with an uptake of 35% in previous screening rounds (2003−06). Sample age was 20−55 yrs and 78% were married. Clinical breast examination was carried out in all while mammogram was done in (n = 324). Cases detected were ductal carcinoma in situ (n = 2) and cancer breast (n = 2). Pathologically both were infiltrating ductal carcinoma. Tumor staging: Stage II: n = 1, Stage IIIB: n = 1.

Conclusion: Factor analysis emphasizes regular screening awareness programmes, providing education, allocation of funds, accessible health care and trained health workers as major interventions to increase uptake of breast cancer screening, and to diagnosis this disease early.

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Physical examination is a valuable tool in the follow up of young women with a history of early breast cancer

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Background: Regular physical examination is recommended in follow up guidelines for breast cancer patients. The objective of this study is to assess the contribution of physical examination in addition to mammography in the early diagnosis of breast cancer recurrences.

Methods: The medical follow-up documents of 669 patients were reviewed. 127 contra-lateral breast cancers and 65 loco-regional recurrences in 169 patients were included. The contribution of physical examination over mammography was evaluated with the proportions of loco-regional recurrences or contra-lateral breast cancers detected by physical examination alone and were assessed stratified for type of recurrences and surgical modalities. The potential impact of patients' age and time from first tumour on the contribution of physical examination was evaluated with Chi-square tests.

Results: Seven (5.5%) out of 127 contra-lateral breast cancer recurrences and 13 (20.0%) out of 65 loco-regional recurrences were detected by physical examination alone. The contribution of physical examination in detecting loco-regional recurrences was not statistically different between patients after mastectomy and patients after breast conserving treatment (25.9% vs. 15.8%; Chi-square=1.014, P = 0.314). There was a trend that the contribution of physical examination is higher in women under 60 years of age than in patients over 60 years of age (14.8% vs. 6.7%; Chi-square=3.304, P = 0.069). There is no significant difference in the contribution of physical examination during the first 5 year and after the first 5 years since diagnosis of the primary tumour (8.0% vs. 13.3%; Chi-square=1.430, P = 0.232).

Conclusions: Some breast cancer recurrences would have been detected later without physical examination. Physical examination has a higher contribution in younger patients (<60).

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The effectiveness of breast cancer screening with MRI and mammography in women with a BRCA1/2 mutation

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Background: The objective of this study is to evaluate the effectiveness of screening with mammography and MRI in detecting breast cancer in BRCA1 or BRCA2 mutation carriers.

Methods: Women who were screened by a surgeon of the Family Cancer Clinic at least once in 2004–2006 were included. Breast cancer screening consisted of clinical breast examination twice a year and annual alternating MRI or mammography, where BIRADS $\geqslant$3 was considered as positive. Sensitivity, specificity, positive and negative predicting values (PPV and NPV) as well as the number needed to screen (NNS) to detect 1 early stage breast cancer, were calculated.

Results: During the screening period 305 mammographies and 256 MRIs were performed in 173 consecutive BRCA1/2 carriers. A total of 13 invasive ductal carcinomas were found of which 3 prevalent, 5 interval and 5 screen-detected carcinomas. The screen-detected and prevalent carcinomas were all diagnosed in stage I/II. Of the 5 interval carcinomas 1 was in stage III. The sensitivities of mammography and MRI were 67% and 71%, respectively. The PPV of mammography and MRI was 60% and 12%, respectively. The NPV was 99% for both tests. The NNS to detect one breast cancer for mammography as well as for MRI were about 50.

Conclusion: MRI has a higher sensitivity than mammography. However, as there are still carcinomas detected with mammography only, mammography is still warranted in breast cancer screening. Given the early stages of detected breast cancers, the current screening policy of BRCA 1/2 mutation carriers seems effective.

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The usefulness of telemammography using soft-copy computed radiography (CR) in screening program for Japanese women

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Background: Digital mammography machines are widely used across Japan, and the majority of them are computed radiography (CR) systems. Therefore, telemammography using soft-copy CR can compensate for the uneven national distribution of mammographers and radiologists in Japan. However, the evaluation of soft-copy interpretation of CR is still controversial because it is usually diagnosed using hard-copy. The purpose of this study is to elucidate the usefulness of telemammography using soft-copy CR in breast cancer screening.

Screenees and Methods: The mammograms of 18,549 screenees had been taken at Kochi Kenshin Clinic using Phase Contrast Mammography (PCM) systems (Konica Minolta Health Care Co. Ltd.) between July 2005 and September 2008. Digital data of them were made by Regius 190 (Konica Minolta), and then processed and compressed to the transferable sized soft-copy by Vox-base II (J-Mac System Inc.). Thereafter, the soft-copy CR were transferred to Kochi Medical School via optic fiber (provided by NTT West co.) and interpreted on 5 mega pixel monitor by the mammographers who were licensed by the central committee on quality control of mammographic screening.

Results: The recall rate was 6.1%, the cancer detection rate 0.33% and the positive predictive value 5.4%. These results were not inferior to those of Kochi prefectural screening program using analogue mammograms of 26,747 screenees (8.7%, 0.34% and 3.9%, respectively).

Conclusion: The long-term results of our telemammographic screening using soft-copy CR had not been inferior to those of analogue mammography. Telemammography using soft-copy CR might be one of promising strategies to overcome the uneven distribution of human resources that participate mammographic screening in Japan. Recently, we structured a mew telemammography network between our institute and five screening facilities including Kochi Kenshin Clinic.

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Ethnicity is a high risk for breast cancer: should we target screening of high-risk groups earlier?

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Background: Breast cancer screening in the United Kingdom is currently indicated in the 50−70 year age group. Previous studies have suggested that patients from minor ethnic groups, especially Afro-Caribbean's, have a worse prognosis after being diagnosed with breast cancer compared to the Caucasian population. We explored whether there are any ethnic differences in the incidence of breast cancer rates among women attending a busy breast clinic at a London University Hospital. We were especially interested in whether there are any benefits of screening the 41−50 year age group in the various ethnic groups.

Materials and Methods: This was a retrospective analysis identifying patients who attended the breast clinic with newly-diagnosed breast cancer. The data was retrieved from the Breast Cancer Registered Database. Our centre has observed one of the highest ethnic population attendance amongst the London Hospitals. The period of study was from March 2002 to March 2009. Patients with previous diagnosis of breast cancer, male patients and those patients not presenting at the Breast clinic were excluded from the study. From the data, the age specific breast cancer distributions (age 21–100 years) of various ethnicities were compared and statistically analysed. Odds Ratio, chi-squared, 95% confidence interval