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# Effectiveness of Single-Photon Emission Computed Tomography (spect-spect/ct) in the Staging of Breast Cancer Patients

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**Objective:** The staging of breast cancer has clinical relevance when treatment options are assessed to plan their individual application. This study evaluated the diagnostic effectiveness of Single-Photon Emission Computed Tomography (SPECT-SPECT/TC) compared to other diagnostics tests in the staging of breast cancer patients.

**Methods:** Relevant studies were identified using specific structured strategies of search for MEDLINE, EMBASE, Cochrane Library, CRD, clinical trials and SCOPUS. Inclusion and exclusion criteria clearly defined were applied to select the articles from the initial list of papers obtained through the systematic search. The quality assessment of diagnostic accuracy (QUADAS) checklist was used to assess quality of studies. Eligibility criteria and QUADAS checklist were independently applied by two scientists, and in case of disagreement, consensus was reached by discussion. Data were extracted independently and their analysis was separately made on patient and lesion-based data. Review Manager 5.0 was used to summarize the methodological quality of studies and also to graphic sensitivity, specificity and receiver operating characteristics (ROC) curves. Metadisk software was used to calculate overall estimations of sensitivity and specificity. A meta-analysis was made for each pair of comparisons of imaging tests to estimate sensitivity and specificity ratios.

**Results:** Eleven studies presented patient-based results, five ones showed lesion-based data and one study presented both results. Fourteen studies compared SPECT and/or SPECT/TC with scintigraphy, one compared them with scintigraphy and magnetic resonance imaging (MRI), another one conducted direct comparisons between SPECT and ecography and the last one compared SPECT with positron emission tomography (PET). SPECT-SPECT/TC had a significant higher sensitivity (89% vs 66%,  $p=0.0032$ ) and non-significant lower specificity (89% vs 95%,  $p=0.752$ ) than scintigraphy in patient-based studies. A proper analysis could not be made between SPECT-SPECT/TC and MRI, PET and ecography because comparisons were based on one single study for each technique.

**Conclusion:** SPECT-SPECT/CT, showed higher sensitivity than scintigraphy for breast cancer patients' staging. More studies are needed to test their effectiveness compared to PET, MRI and ecography.

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# Pre-operative Ultrasound Staging of the Axilla in Breast Cancer – Repeat Audit Cycle

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**Introduction:** Axillary ultrasound (AUS) for axillary staging of breast cancer is a standard procedure now to identify metastatic lymph nodes (LN). In 2009 we retrospectively audited AUS for axillary staging and found a sensitivity of 57.7% and specificity of 92.7% in our breast unit. However, only 50% of abnormal nodes were AUS-guided biopsied. In this study we aim to close the audit cycle by assessing whether the prevalence of AUS has increased and more abnormal nodes have been biopsied.

**Methods:** We retrospectively studied all breast cancer patients between March 2010 and 2011. Patients were diagnosed in the symptomatic clinic with invasive breast cancer and all had axillary surgery. Exclusion criteria were: DCIS alone, previous axillary surgery or presence of an axillary mass. Results were compared to previous audit cycle of 2009–2010.

**Results:** 95 of the 108 patients (87.9%) underwent AUS and 31 patients were LN positive on final histology. AUS detected 15 of these 31 LN positive patients. There were further 3 abnormal scans in LN negative patients. 11 biopsies were performed and all correlated with final pathology. This gave a positive predictive value (PPV) of 83.3% and a negative predictive value (NPV) of 79.2%. The specificity and sensitivity of AUS was 95.3% and 48.4% respectively.

**Conclusion:** prevalence of AUS for axillary staging increased by 8.9% and AUS-guided biopsy of ultrasonographically abnormal LNs rose by 20% compared to previous audit cycle. PPV and specificity also increased by 4.4% and 2.6%, respectively. We met our previous targets and improved the service.

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# Doppler Ultrasound Scoring to Predict Chemotherapeutic Response in Advanced Breast Cancer

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**Background:** Doppler ultrasonography (US) is increasingly being utilized as an imaging modality in breast cancer. It is used to study the vascular characteristics of the tumour. Neoadjuvant chemotherapy is the standard modality of treatment in locally advanced breast cancer. Histological examination remains the gold standard to assess the chemotherapy response. However, based on the color Doppler findings, a new scoring system that could predict histological response following chemotherapy is proposed.

**Materials and Method:** Fifty proven cases of locally advanced infiltrating duct carcinoma of the breast were studied. The mean age of the patients was 44.5 years. All patients underwent clinical and Doppler assessment followed by three cycles of CAF (Cyclophosphamide, Adriamycin and 5-Fluorouracil) chemotherapy. Repeat clinical and Doppler examination following three cycles was done followed by surgery. The removed specimens were examined for histological response which was correlated with Doppler findings. The Doppler characteristics of the tumour were graded as 1–4 based on <25%, 25–50%, >50% and complete disappearance of flow signals respectively. A cumulative score was calculated and compared with histopathological response. Results were analyzed using Chi square test, sensitivity, specificity, positive and negative predictive values.

**Results:** The maximum Doppler score according to the proposed scoring system was twelve and minimum three. Higher scores corresponded with a more favorable histopathological response. Twenty four patients had complete response to chemotherapy. Sixteen of these 24 patients (66.7%) had a cumulative Doppler score more than nine. The sensitivity of cumulative score >5 was 91.7% and specificity was 38.5%. The area under the ROC curve of the cumulative score >9 was 0.72.

**Conclusion:** Doppler scoring can be accurately used to objectively predict the response to chemotherapy in patients with locally advanced breast cancer and it correlates well with histopathological response.

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# Molecular Imaging of Breast Tumours with PET-MRI – Proof of Concept

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**Introduction:** To proof that that molecular imaging of breast tumours with protonMR spectroscopy, diffusion-weighted imaging, contrast-enhanced MRI and positron-emissiontomography improves diagnostic accuracy, sensitivity and specificity in cancer diagnosis.

**Methods:** 49 patients with a suspicious breast were included in this IRB approved prospective study. All patients were examined with dedicated <sup>18</sup>FDG-PET-CT and 3T multiparametric MRI of the breast. MRIprotocol included: a diffusion-weighted sequence (DWI), a T2-wsequence and a contrast-enhanced 3D-T1-w sequence (CE-MRI) before and after application of a standard dose Gd-DOTA. Afterinjection of approx. 300 MBq <sup>18</sup>F-FDG based on the patients weight PET-CT was acquired in theprone position allowing the same patient geometry in breast MRI. CT datawas used for attenuation correction. Co-registration of imaging data and imagefusion were performed. PET-MRI was assessed for lesion morphology and EH-kineticsaccording to BIRADS, restricted diffusivity, increased Choline (Cho)-levels and<sup>18</sup>FDG -avidity. AnADC threshold 1.25 x10–3 mm2/s and a signal-to-noise ratio of the Choresonance peak >2.55 were defined asa marker of malignancy. Lesions classified as positive when <sup>18</sup>F-FDG-uptakewas greater than blood-pool activity. All lesions were histopathologicallyverified.

**Results:** Multimodal multiparametric PET-MRI achieved an excellent sensitivity of 100% and good specificity of 81% inthe diagnosis of breast cancer. Diagnostic accuracy was 94%. PET-MRI increased sensitivity in the diagnosis of lymphnodemetastases from 71% to 88% compared to MRI alone.

**Conclusions:** Molecular imaging of breast lesions with PET-MRI increases sensitivity, specificity and diagnostic accuracy in the diagnosis of breast cancer and lymphnode metastases.