

**P2**

**Flat epithelial atypia: biological significance on core biopsy**

S Rajan, A Shaaban, B Dall, N Sharma  
 Leeds Teaching Hospitals NHS Trust, Leeds, UK  
*Breast Cancer Research* 2010, **12(Suppl 3)**:P2 (doi: 10.1186/bcr2655)

**Introduction** Flat epithelial atypia (FEA) is seen with increasing frequency following biopsy of calcification detected through screening. FEA is often associated with more significant lesions including atypical ductal hyperplasia and ductal carcinoma *in situ* (DCIS). It is postulated that FEA may even represent the earliest morphological manifestation of DCIS and a precursor to invasive carcinoma. However, the significance of pure FEA still remains unclear. We aim to review the radiological and pathological features of FEA and evaluate the significance of FEA on needle core biopsy.

**Methods** We performed a retrospective analysis of all needle core biopsies containing FEA in the pathology database from April 2008 to April 2010. For each case the following data were recorded: mammographic features, method of further sampling (mammotome or diagnostic surgical biopsy) and histology from needle core biopsy, mammotome biopsy and surgical biopsy.

**Results** There were 35 needle core biopsies that contained pure FEA, of which 89% (31/35) were associated with mammographic calcification. Following initial core biopsy, 21 patients had further sampling with mammotome biopsy, 13 patients underwent diagnostic surgical biopsy and one patient was not suitable for further intervention. There was an upgrade to DCIS in 18% (6/34) and invasive carcinoma in 3% (1/34).

**Conclusions** Pure FEA on core biopsy is upgraded to carcinoma in 21% (7/34) of cases on further sampling and it is vital that we do not underestimate the biological significance of FEA. Increasing the awareness of FEA is crucial to ensure consistent and appropriate patient management.

**P3**

**Two-view 2D digital mammography versus one-view digital breast tomosynthesis**

MJ Michell, RK Wasan, A Iqbal, C Peacock, DR Evans, JC Morel  
 King's College Hospital, London, UK  
*Breast Cancer Research* 2010, **12(Suppl 3)**:P3 (doi: 10.1186/bcr2656)

**Introduction** In routine breast screening using 2D digital mammography (2DM), mediolateral-oblique (MLO) and craniocaudal (CC) views are performed to maximise cancer detection. Digital breast tomosynthesis (DBT) improves the visibility of lesions by eliminating the problem of superimposition of normal structures, and there is uncertainty regarding the need for two views. The purpose of this study is to compare the accuracy of two-view 2DM with one-view DBT.

**Methods** Five hundred and one cases were evaluated from the DBT trial dataset of clients recalled for further workup after their initial film-screen mammography. Bilateral two-view 2DM and DBT examination were performed in all study subjects. Mammography scores (1 to 5) based on RCR Breast Group criteria were recorded and an overall score for 2DM was established based on the highest value of MLO and CC scores. Unblinded interpretation of the 2DM followed by MLO-alone DBT was carried out. Statistical analysis was done using the receiver-operative characteristic (ROC).

**Results** There were 111 (22.1%) cancers. The ROC area under the curve (AUC) for two views combined 2DM was 0.915 and for MLO-alone DBT was

0.960 (difference 0.045;  $P = 0.009$ ). The distribution of M-scores against the histology-proven malignant lesions is presented in Table 1.

**Conclusions** In this series, one-view (MLO-alone) DBT had superior sensitivity compared with two-view 2DM.

**P4**

**Accuracy of breast cancer detection with full-field digital mammography and integral computer-aided detection correlated with breast density as assessed by a new automated volumetric breast density measurement system**

K Pinker<sup>1,2</sup>, N Perry<sup>2</sup>, S Milner<sup>2</sup>, K Mokbel<sup>2</sup>, S Duffy<sup>3</sup>  
<sup>1</sup>Department of Radiology, Division of Molecular and Gender Imaging, Medical University Vienna, Austria; <sup>2</sup>Princess Grace Hospital, The London Breast Institute, London, UK; <sup>3</sup>Wolfson Institute, Queen Mary College, University of London, UK  
*Breast Cancer Research* 2010, **12(Suppl 3)**:P4 (doi: 10.1186/bcr2657)

**Purpose** To assess the diagnostic performance of computer-aided detection (CAD) for full-field digital mammography (FFDM) correlated with breast density assessed by an automated breast density measurement system (Hologic, Quantra) in breast cancers and age-matched healthy controls.

**Materials and methods** Two hundred breast cancers imaged with FFDM and 200 age-matched healthy controls were evaluated retrospectively using CAD. A CAD mark was scored true-positive if it correctly indicated a malignant lesion. All other CAD marks were considered false. CAD sensitivity and specificity were calculated and correlated with mammographic breast density (%).

**Results** CAD correctly identified 157 of the 200 cancers, a sensitivity of 79%. Sensitivity was suggestively but nonsignificantly lower with increased density ( $P = 0.09$ ). In those cancer cases with density at or below the median of 20%, sensitivity was 82%, compared with 75% in those with density above the median. The presence of one or more false CAD prompts was suggestively but not significantly more likely in controls than cases (87% vs. 80%,  $P = 0.06$ ). The number of false prompts was significantly higher in controls (average 3.6 vs. 2.6,  $P < 0.001$ ). False prompts were significantly less likely with higher density ( $P = 0.008$ ). False prompts were present in 86% of cases and controls with density at or below the median, and in 81% of those with density above the median.

**Conclusions** Increased breast density is significantly associated with higher specificity of CAD, and there is suggestive evidence that it is also associated with lower sensitivity.

**P5**

**Surveillance following breast cancer: is it cost-effective?**

L Tennent<sup>1,2</sup>, G MacLennan<sup>1</sup>, SD Heys<sup>3,4</sup>, F Gilbert<sup>4,5</sup>, L Vale<sup>1,2</sup>, Mammographic Surveillance HTA Group  
<sup>1</sup>Health Services Research Unit, University of Aberdeen, UK; <sup>2</sup>Health Economics Research Unit, University of Aberdeen, UK; <sup>3</sup>Division of Applied Medicine, School of Medicine and Dentistry, University of Aberdeen, UK; <sup>4</sup>Aberdeen Royal Infirmary, NHS Grampian, Aberdeen, UK; <sup>5</sup>Aberdeen Biomedical Imaging Centre, University of Aberdeen, UK  
*Breast Cancer Research* 2010, **12(Suppl 3)**:P5 (doi: 10.1186/bcr2658)

**Introduction** There is debate about the role and optimal organisation of follow-up following treatment for primary breast cancer. We estimated using the best available evidence whether early detection by surveillance of ipsilateral breast tumour recurrence (IBTR) and metachronous contralateral breast cancer (MCBC) was cost-effective.

**Methods** An economic model compared alternative surveillance strategies involving mammographic surveillance and/or clinical follow-up performed at differing surveillance intervals. The model structure was based upon discussions with the clinical experts involved in the study, a survey of UK breast surgeons and radiologists, and the literature. Data to populate the model came from a series of systematic reviews and an analysis of the West Midlands Cancer Intelligence Unit Breast Cancer Registry. Results of the model were presented as incremental cost per QALYs – a measure of relative efficiency.

**Results** The surveillance strategy most likely to be cost-effective was mammographic surveillance alone provided every 12 to 24 months. This result held for women who had previously received either breast-conserving surgery or mastectomy. Results were sensitive to primary tumour characteristics (size,

**Table 1 (abstract P3)**

| Imaging score | MLO-CC combined 2DM, n (%) | MLO-alone DBT, n (%) | Percentage difference, Δ |
|---------------|----------------------------|----------------------|--------------------------|
| M1            | 1                          | 0                    | 0                        |
| M2            | 0                          | 0                    | 0                        |
| M3            | 28 (25.2%)                 | 18 (16.2%)           | ↓9%                      |
| M4            | 32 (28.8%)                 | 26 (23.4%)           | ↓5.4%                    |
| M5            | 50 (45.0%)                 | 67 (60.3%)           | ↑15.3%                   |

grade, nodal involvement) used to define the likelihoods of developing an IBTR or MCBC. More intensive follow-up of women with higher likelihood of developing IBTR or MCBC may be worthwhile.

**Conclusions** Our conclusions remain tentative due to the paucity of the underlying evidence base but suggest surveillance is likely to improve survival, with a strategy of mammography alone every 12 to 24 months appearing cost-effective.

#### P6

##### **A pilot study to evaluate assisted freehand ultrasound elasticity imaging in the sizing of early breast cancer: a comparison of B-mode and assisted freehand ultrasound elasticity ultrasound with histopathology measurements**

R English<sup>1</sup>, J Li<sup>2</sup>, A Parker<sup>1</sup>, D Roskell<sup>1</sup>, RF Adams<sup>1</sup>, V Parulekar<sup>1</sup>, J Baldwin<sup>1</sup>, Y Chi<sup>2</sup>, A Noble<sup>2</sup>

<sup>1</sup>Oxford Radcliffe Hospitals NHS Trust, Oxford, UK; <sup>2</sup>University of Oxford, UK  
*Breast Cancer Research* 2010, 12(Suppl 3):P6 (doi: 10.1186/bcr2659)

**Purpose** Preoperative breast cancer sizing is required for surgical planning. Breast ultrasound is widely used but may not be accurate. Assisted freehand ultrasound (AFUSON) of the breast is a novel method of ultrasound scanning, combining semi-automated elasticity ultrasound with B-mode imaging. This pilot study investigates whether AFUSON sizing corresponds more closely with wide local excision tumour dimensions than with B-mode alone.

**Methods** Twenty-three patients with early breast cancer were recruited with ethical approval through the NHSBSP. B-mode ultrasound and AFUSON images were acquired in predefined planes. Pathology slices were taken in the corresponding longitudinal plane and were digitally scanned. Assessment of tumour dimensions, area and contour were made on B-mode, AFUSON and histopathology scans. The findings were correlated.

**Results** Although there were significant limitations in this pilot study, the tumour dimension accuracy increased from 66% (B-mode alone) to 82% (AFUSON). Tumour area accuracy increased from 61% (B-mode alone) to 90% (AFUSON). Some AFUSON contour images showed a high visual correlation with the equivalent histopathology scans.

**Conclusions** This pilot study suggests that AFUSON may be useful in early breast cancer sizing. Further studies will be done to acquire more data and to address some of the shortfalls in the study.

#### P7

##### **Promoting early symptomatic presentation in older women with breast cancer in the NHS breast screening programme**

LJL Forbes<sup>1</sup>, L Atkins<sup>1</sup>, S Sellars<sup>2</sup>, J Patnick<sup>2</sup>, L Tucker<sup>1</sup>, AJ Ramirez<sup>1</sup>

<sup>1</sup>King's College London, London, UK; <sup>2</sup>NHS Screening Programmes, Sheffield, UK  
*Breast Cancer Research* 2010, 12(Suppl 3):P7 (doi: 10.1186/bcr2660)

**Introduction** Women over 70 have poorer breast cancer survival than younger women, and this may be due to late stage at presentation [1]. Promoting early presentation with symptoms in older women attending for their final round of breast screening may reduce stage at diagnosis cost-effectively, and is unlikely to lead to overdiagnosis. We tested the efficacy of the 10-minute radiographer-delivered Promoting Early Presentation (PEP) Intervention to promote early presentation by increasing breast cancer awareness in the NHS Breast Screening Programme.

**Methods** We randomised 867 women attending their final round of screening to receive the PEP Intervention or usual care, measuring breast cancer awareness at baseline and 1 year. We systematically reviewed the evidence of effectiveness of interventions to promote cancer awareness and early presentation.

**Results** At 1 year, the intervention increased the proportion breast cancer aware compared with usual care (24% vs. 4%; odds ratio = 15.2, 95% CI = 4.8 to 47.8). The systematic review found one randomised trial of a one-to-one intervention that showed a much smaller effect on breast cancer awareness.

**Conclusions** The PEP Intervention is more effective than any other intervention to promote breast cancer awareness. It will now be offered to all women attending for a final mammogram in three NHS breast screening services, to assess costs and feasibility and to measure its effect on breast cancer awareness in routine clinical practice. If implemented across the whole Programme, the PEP Intervention has the potential to reduce avoidable deaths from delayed symptomatic presentation in older women.

#### Reference

1. Moller H, Sandin F, Bray F, Klint A, Linklater KM, Purushotham A, Robinson D, Holmberg L: Breast cancer survival in England, Norway and Sweden: a population-based comparison. *Int J Cancer* 2010, 127:2630-2638.

#### P8

##### **Mammographic follow-up of patients after treatment for breast cancer: is 5 years enough?**

D Vaile<sup>1</sup>, LB Williams<sup>1</sup>, AC Borley<sup>2</sup>, PJ Barrett-Lee<sup>2</sup>, P Young<sup>3</sup>

<sup>1</sup>Velindre Cancer Centre, Cardiff, UK; <sup>2</sup>Velindre Cancer Centre, Cardiff, UK; <sup>3</sup>University Hospital of Wales, Cardiff, UK

*Breast Cancer Research* 2010, 12(Suppl 3):P8 (doi: 10.1186/bcr2661)

**Introduction** Velindre Cancer Centre (VCC), Cardiff provides radiotherapy and oncology services to the population of 1.5 million across southeast Wales. Historically at Velindre, breast cancer patients are followed up for at least 10 years, with annual mammography underpinning the service. The optimal length for continued annual surveillance has been debated and reduction to 5 years follow-up suggested. Therefore, a retrospective audit of breast cancers diagnosed on follow-up mammograms was undertaken to support the proposed reduced length of mammographic follow-up.

**Methods** Using the RIS and HIS electronic databases, follow-up mammograms over a 3-year period from 1 June 2006 to 31 May 2009 were collected and their report codes checked. All mammogram reports are coded using the Breast Imaging Reporting and Data System (BI-RADS). All mammograms coded 3 and above were identified. Subsequent radiological and histological reports were reviewed to identify confirmed malignancies.

**Results** In this 3-year period, there were 6,294 follow-up mammogram examinations at VCC. Ninety-seven reports were coded 3 or above (1.5%). Fifty-six new malignancies were confirmed. Of these, 44 (79%) occurred more than 5 years from original diagnosis.

**Conclusions** The results do not support reducing the length of follow-up to 5 years. Further analysis of original pathology will be undertaken to attempt to risk-stratify patients and thus allow tailored follow-up regimes to be developed.

#### P9

##### **An investigation of workstation image manipulation usage when examining FFDM images**

Y Chen<sup>1</sup>, J James<sup>2</sup>, A Evans<sup>3</sup>, A Turnbull<sup>4</sup>, A Gale<sup>1</sup>

<sup>1</sup>Loughborough University, Loughborough, UK; <sup>2</sup>Nottingham Breast Institute, Nottingham, UK; <sup>3</sup>University of Dundee, UK; <sup>4</sup>Derby Breast Unit, Derby, UK

*Breast Cancer Research* 2010, 12(Suppl 3):P9 (doi: 10.1186/bcr2662)

**Introduction** With the introduction of digital breast screening across the UK, screeners need to learn how best to inspect these images. A key advantage over mammographic film is the facility to use workstation image manipulation tools.

**Methods** Forty two-view FFDM screening cases, representing malignant, normal and benign appearances, were examined by 14 radiologists and advanced practitioners from two UK screening centres. For half the cases, the mammography workstation image manipulation tools could be employed; and for the other half these were not used. Participants classified each case and indicated whether an abnormality was present. Throughout the study, the participants visual search behaviour as well as their image manipulations were recorded.

**Results** Whether or not image manipulation tools were used made very little difference to overall performance (*t* test, *P* > 0.05) as confirmed by JAFROC analysis figure-of-merit values of 0.816 and 0.838 (with and without tools, respectively); performance not using tools was better. However, using tools significantly increased inspection time (*P* < 0.5) as well as participants' confidence. Detailed examination of participants' image inspection behaviour elicited that when imaging tools were used then they spent 17 to 77% of their time manipulating the images; with the less experienced participants spending more time using such tools. Eye movement data demonstrated that when abnormalities were missed then this was typically due to search errors.

**Conclusions** For these cases, whilst using imaging tools was not necessary to identify abnormalities, their use improved confidence, especially in identifying normal appearances. With experience, less use of such tools was evident.