Abstracts from Symposium Mammographicum 2004 Edinburgh International Conference Centre, 19–20 July 2004

1 Developing new treatments for breast cancer

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Twenty-five years after its first description the p53 protein has been shown to play a key role in both cancer and ageing. The p53 protein is activated by many different stress pathways, including oncogene action and DNA damage. The elucidation of the p53 response, which is aberrant in most cancers (including breast, lung, stomach and colorectal cancer), has provided many new targets for drug development and p53 gene therapy is now approved in China. In tumours where p53 is mutant small molecules may be able to restore its function. In many tumours the wild-type p53 gene remains intact but its function is compromised by loss of upstream signalling pathways or downstream effectors. A key regulator is Mdm2, an E3 ubiquitin ligase, that binds and ubiquitinates p53 and directs its degradation via the proteosome. Small potent peptides that can block the p53 Mdm2 interaction and activate the p53 response have been described. Growing selections of lead small molecules that mimic the action of these peptides have also been recently discovered. Cell-based screens have revealed that inhibitors of nuclear export and inhibitors of transcription (one of which is in clinical trial) can also activate the p53 response therapeutically. The pharmaceutical regulation of the p53 pathway offers great hope for improved treatment of human cancer.

2 Mammographic screening with a breast cancer prevention programme

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Breast Cancer Res 2004, **6(Suppl 1)**:P2 (DOI 10.1186/bcr821)

3 Sonographic evaluation of solid breast nodules

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Because of the heterogeneity of breast cancer from nodule to nodule, single findings cannot achieve the sensitivity or the negative predictive value necessary to identify a low-risk group that can be offered the option of follow-up (ACR Breast Imaging Reporting and Data System [BIRADS] 3 group). However, by using multiple findings in a strict algorithm, such a group can be identified. It is also important to keep in mind that breast cancer can be heterogeneous within an individual nodule. Part of the nodule may have circumscribed features that simulate a benign lesion, while another part may be spiculated and obviously malignant. Only by scanning the whole surface and substance of the nodule in two orthogonal planes (radial and anti-radial) can the presence of suspicious findings be excluded, and if there is a mixture of benign and suspicious findings, the benign findings should be ignored.

These studies show that sonography is useful in the characterization of solid breast masses. Characterizing solid breast nodules into BIRADS categories defines carcinomas that might have been missed clinically or mammographically. It identifies a BIRADS 3 group that has far less than 2% risk of being malignant and can offer the patient the option of follow-up rather than biopsy. Currently, approximately 80% of patients with BIRADS 3 solid nodules are electing to be followed rather than to undergo biopsy. It improves the accuracy of the diagnosis of malignant breast lesions. Importantly, it also accurately defines a population of benign solid breast lesions that do not require biopsy when strict sonographic criteria of benignity are present.

To achieve the desired sensitivity and negative predictive values of 98% or greater the algorithm must be strictly adhered to. When the patient elects to be followed rather than undergo biopsy, follow-up should be performed in 6 months, not 1 year. The malignant lesions at most risk to be mischaracterized as BIRADS 3 are higher grade invasive ductal carcinomas that grow rapidly enough for change to be readily detected at 6 months.

Table 1

Current study: characterization of solid breast nodules

	Benign histology	Malignant histology	All biopsies
Negative US (BIRADS 2, 3)	245 (true negatives)	1 (false negatives)	246
Positive US (BIRADS 4a, 4b, 5)	559 (false positives)	406 (true positives)	965
Total	804	407	1211

Sensitivity = 406/407 = 99.8%. Negative predictive value = 245/246 = 99.6%. Specificity = 245/804 = 30.5%. Positive predictive value = 406/965 = 42.1%. Accuracy = (245 + 406)/1211 = 53.8%.

Table 2

Prospective characterization of 1211 solid nodules into BIRADS categories (all 1211 nodules have undergone biopsy)

BIRADS category	Number of nodules biopsied	Number of malignant nodules	Expected risk of cancer (%)	Actual risk of cancer (%)
2	15	0	0	0
3	231	1	≤ 2	0.4
4a	515	52	3–49	10
4b	191	118	50–89	62
5	259	236	≥ 90	91
Total	1211	407		34

4 Patient safety: why do things go wrong?

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Concern over the levels of patient safety within hospitals was raised following a series of studies showing unacceptable rates (3–17% of admissions) of adverse events (injury to patients). Government health agencies acknowledged that the standard of safety for patients was unacceptable and that healthcare providers would be required to tackle this issue. Other industries, particularly in the more hazardous sectors such as energy production, take a very systematic approach to managing safety. They have realized that human factors play a major contributing role to accident causation, but that this encompasses not just the humans operating the system, but also the humans who are managing the organization. Leape and colleagues [1] argued that many hospital systems are designed to rely on the error-free performance of individuals, whereas in industry it is appreciated that human error is inevitable and that accidents occur due to both human failures and latent conditions. Both are influenced by the underlying safety culture of the organisation (e.g. level of management commitment to safety). Drawing on psychological research into safety management in high-risk industries, this paper examines three techniques used to diagnose the state of safety: measuring safety climate; assessing senior managers' commitment to safety; and evaluating nontechnical skills for safety critical positions.

Reference

1. Leape L, Woods D, Hatlie M, Kizer K, Schroeder S, Lundberg G: **Promoting patient safety by preventing medical error.** *J Am Med Assoc* 1998, **280:**1444-1447.

5 Critical incident reporting in the National Health Service breast units

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Breast Cancer Res 2004, **6(Suppl 1)**:P5 (DOI 10.1186/bcr824)

The Royal College of Radiologists (RCR) Breast Group has recently launched a Critical Incident reporting scheme. The aim is to collect data on adverse events specific to breast imaging in the hope of alerting units to potential hazards and incidents in a timely fashion (rather than reading about them in the newspapers!). Critical Incident reports can be submitted online

(http://www.rcrbreastgroup.com) or in paper form using either the RCR Breast Group or local incident form. This is not intended to replace the national scheme for reporting being developed by the National Patient Safety Association. Events collected to date already reveal common themes such as mistakes surrounding biopsy specimen handling and patient identification.

6 Biopsied in the USA

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Breast Cancer Res 2004, **6(Suppl 1)**:P6 (DOI 10.1186/bcr825)

Fine needle aspirate and core biopsy are well established techniques in the UK for achieving preoperative diagnoses for palpable and impalpable breast lesions. Since the mid-1990s the number of units using Mammotome has steadily increased; as yet no randomised trial comparing vacuum-assisted biopsy against automated core biopsy has been published. However, a critical review of currently available literature has shown a significant decrease in the high-risk lesion underestimate rate and a nonsignificant decrease in the ductal carcinoma *in situ* underestimate rate when compared with published data on 14 G core biopsy [1]. The aim of this bursary was to visit two centres in the US and briefly review the next generation of 'post mammotome' biopsy devices that are in routine use and likely to be launched in the UK. As none of these devices have been subject to a randomised trial this report is a subjective evaluation of these techniques by a UK practitioner working in the National Health Service Breast Screening Programme and Symptomatic Breast Imaging service.

Reference

1. Hoornjte LE, *et al.*: **Vacuum-assisted breast biopsy: a critical review.** *Eur J Cancer* 2003, **39:**1676-1683.

7 The impact of mammographic screening on breast cancer mortality: overview of the evidence so far

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Controversy remains over the scale of benefit women can expect from attending mammographic screening programs. We review the evidence, presenting (1) an updated meta-analysis of the latest results from the randomised trials and (2) an overview of the non-randomised evidence.

After eight randomised trials with 12–20 years follow-up, the pooled results show a significant 20% (95% confidence interval [CI]: 14%, 27%) reduction in breast cancer mortality associated with invitation to screening. When stratified by age, the reductions were 15% (95% CI: 2%, 27%) for women aged under 50 and 22% (95% CI: 14%, 30%) for women aged 50–74.

The search strategy for nonrandomised evidence relating to mortality yielded 12 descriptive studies, seven case-series, six case–control, eight cohort and three nonrandomised comparative studies. All indicated some benefit associated with screening. Overall, the case–control studies indicated a 35% (95% CI: 20%, 48%) reduction in breast cancer mortality associated with screening. The corresponding reduction for cohort studies was 44% (95% CI: 39%, 48%) for screening and 31% (95% CI: 21%, 40%) for invitation.

The majority of evidence from randomised and nonrandomised sources demonstrates a reduction in breast cancer mortality with screening. Studies should continue to monitor the benefit of screening programmes, taking care to address potential forms of bias.

8 A case–control study to estimate the impact on breast cancer death of the breast screening programme in Wales

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Breast Cancer Res 2004, **6(Suppl 1)**:P8 (DOI 10.1186/bcr827)

We set up a case–control study to estimate the effect of service screening, as provided by the National Health Service breast screening programme, on breast cancer mortality in Wales. The basic design was a case–control study with 1:2 matching using data recorded by Breast Test Wales. The cases are deaths from breast cancer in women aged 50–75 years, diagnosed after the instigation of screening in 1991 and at age 50 or over. The controls are women who have not died of breast cancer, matched by risk set and year of birth. We recruited 436 cases and 750 controls.

The odds ratio for risk of death from breast cancer for women who have attended at least one routine screen compared with those never screened was 0.62 (confidence interval:

0.47–0.81), which suggests a reduction in risk of 38%, and no smaller than 19%. After correcting for anticonservative and conservative biases, the estimated mortality reduction was 25% (odds ratio = 0.75; 95% confidence interval: 0.49, 1.14; $P = 0.09$).

This study suggests that the Breast Test Wales screening programme is achieving a 25–38% reduction in breast cancer mortality in women attending for screening, consistent with the results of the randomized controlled trials of mammographic screening.

9 Quality management: the key to achievement for the BreastScreen Australia Programme

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Breast Cancer Res 2004, **6(Suppl 1)**:P9 (DOI 10.1186/bcr828)

The BreastScreen Australia Programme commenced in 1991. Since then a national network of breast cancer screening services has been established.

The Programme is underpinned by a quality management infrastructure with national and State/Territory roles and responsibilities. All BreastScreen Australia services must comply with National Accreditation Standards. To monitor quality at the service, State and National level, all services collect the National Minimum Dataset using the National Data Dictionary. Monitoring and Evaluation Plans are being implemented with annual reporting undertaken by the Australian Institute of Health and Welfare. A key evaluation project commissioned by the Programme is the mortality study.

During the period 1996–2001 BreastScreen Australia screened over 4.5 million women, and has consistently maintained cancer detection rates and detection rates for small cancers at or above minimum standards set for services to achieve.

Since the commencement of the BreastScreen Australia Programme there has been a 23.7% reduction in the death rate from breast cancer in women aged 50–69 years. The 5-year survival rate after diagnosis from breast cancer increased from 72.3% during 1982–1986 to 84% between 1992 and 1997.

This presentation will outline of the quality management infrastructure and key achievements of BreastScreen Australia.

Reference

BreastScreen Australia Monitoring Report 2000–2001. Canberra: Australian Institute of Health and Welfare; 2003.

10 Breast screening radiographers and radiologists: performance and confidence levels on the PERFORMS film sets

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Breast Cancer Res 2004, **6(Suppl 1)**:P10 (DOI 10.1186/bcr829)

Specially trained radiographers are increasingly double-reading screening cases with radiologists. Each year the majority of these film-readers interpret a 'PERFORMS' set of difficult cases as a means of self-assessing their skills. We examined the radiographers' confidence in their interpretation of these difficult cases and investigated whether they performed as well as radiologists. We also studied radiographers' performance and confidence ratings over a number of years, comparing those with different levels of experience. Additionally, by closely matching individual radiographers and radiologists, we investigated real-life experience, performance and confidence levels on PERFORMS, fractionating by both volume of cases read, and years of experience. Data were examined for approximately 250 breast-screening radiologists and 90 specially trained radiographers over 3 years. Overall, radiographers did not perform as well as radiologists on this particular task, nor were they as confident of their diagnosis. However, when closely matched on real-life factors these differences in performance levels disappeared and radiographers performed as well as radiologists. Although the more experienced radiographers performed at a level similar to the radiologists, differences in confidence levels remained. This supports the current UK practice of radiographers double-reading with radiologists and implies that experienced radiographers, like radiologists, may be able to be single-readers.

11 A 3-year audit of radiographer screen film reading

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A team of five radiographers assists with film reading in our large combined screening and symptomatic breast unit. The first were trained in 1999, and now have 5 years experience. For the last 3 years their screen reading performance has been intensively audited.

Film reading numbers have ranged from 4.8 to 11,000/year. Cancer detection rates average 6/1000, with the best radiographer achieving 7/1000. Recall rates are kept low by consensus review of all recalls, less than 5%.

Film reading performance in real life does reflect the 'PERFORMS' score.

Lobular cancers are more likely to be missed by new film readers and are disproportionately over-represented in the 'minority report' cancers detected.

In conclusion, radiographers perform as well as average breast-screening radiologists after 3 years supervised experience.

12 Determinants of false positive recall rates in an Australian mammographic screening programme

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Breast Cancer Res 2004, **6(Suppl 1)**:P12 (DOI 10.1186/bcr831)

We assessed the clinical and service related determinants of false positive recall using a case–control study of women who attended BreastScreen Victoria between 1994 and 1999. Cases were randomly selected from all women who were recalled for assessment but did not have cancer (false positives), and controls were selected from women who had a negative assessment and did not have cancer. Separate analyses were conducted for first ($n = 12,667$) and subsequent rounds ($n = 17,461$).

To identify reader characteristics associated with false positive recall we conducted generalised linear modeling of all women who attended between 1994 and 1999.

In the case–control study year of screen, strong family history and age at screening were important predictors of false positive recall at first round. At subsequent rounds, age, time since introduction of Kodak MIN-R-2000 film, strong family history of breast cancer, hormone replacement therapy use, recall at previous screen, previous screen at more than 27 months and screening round were significant predictors.

In the analysis of reader characteristics, false positive recall rates were found to increase with increasing number of screening reads per reader over the preceding 12-month period, but the number of assessment clinics each reader had attended heavily modified this finding.

13 Hormone replacement therapy, percent mammographic density and the sensitivity of mammography

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We examined the extent to which the lower mammographic sensitivity found in hormone replacement therapy (HRT) users could be explained by any association of HRT use with higher density and more difficult to detect cancers (e.g. lobular cancers). Eligible women included women aged 55 years and older who attended BreastScreen Victoria for first-round screening mammography in 1994 and 1995 (1086 breast cancers) and for subsequent-round screening (471 breast cancers) in 1995 and 1996. Percent density was measured on a continuous scale, blinded, using a reliable, computer-assisted method.

True positive cancers were invasive breast cancers diagnosed at screening and false negative cancers were cancer diagnosed within 24 months of a negative screening examination. After adjusting for age, symptom status, family history, past history of mammography (at first round) and time since screen (at subsequent round), HRT users had higher risk of having a false negative (first round: odds ratio [OR], 1.99; 95% confidence interval [CI], 1.4–2.9 and subsequent round: OR, 2.29; 95% CI, 1.4–3.8). This effect was attentuated by adjusting for mammographic density (first round: OR, 1.54; 95% CI, 1.0–2.3 and subsequent round: OR, 1.97; 95% CI, 1.2–3.3), indicating the density only partly explains the effect of HRT on sensitivity.

14 Size distribution of screen-detected and interval cancers according to breast density suggests reduced screening benefit for women with higher density breasts

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Previous research has consistently demonstrated lower mammographic sensitivity for women with denser breasts, arguably due to masking of tumours in dense breasts. Masking would be observable as a shift in the size distribution of

tumours towards large cancers in dense breasts at screening, with smaller cancers missed in those breasts appearing later.

We compared tumour size by density and detection point (first and second round screen-detected and interval cancers) using quantiles of continuous percentage density and histological tumour size for 2430 invasive cancers (screen-detected and interval) detected in Victoria, Australia.

Tumour size increased with density quantile for incident screen-detected cancers (e.g. median size was 12 mm for densities less than 4.5% and 15 mm for densities over 26.2%). The relationship between size and density was more complex at other detection points. Histograms of size quintiles revealed patterns consistent with masking. For example, interval tumours following incident screening showed more cancers in the smallest size quintile (less than 8 mm) in high-density breasts (15.4%) than low-density breasts (8.7%), and at second-round screening low-density breasts revealed more small tumours (28.3%) than high-density breasts (18.5%).

Australian breast screening missed smaller cancers in women with high-density breasts, reducing their benefit from the current breast-screening programme.

15 Using magnetic resonance to diagnose breast cancer and predict therapeutic response

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Breast Cancer Res 2004, **6(Suppl 1)**:P15 (DOI 10.1186/bcr834)

Introduction: Neoplastic tissue contains elevated levels of choline-containing metabolites (tCho) [1,2]. The purpose of this study is to determine whether magnetic resonance spectroscopy (MRS) with magnetic resonance imaging (MRI) can be a noninvasive technique for determining whether a breast abnormality is benign or malignant and to monitor response to neoadjuvant chemotherapy (CT).

Materials and methods: Women scheduled for a breast biopsy or scheduled to CT were recruited for our study. All studies were done with a 4 T MRI/MRS scanner. A baseline scan was done prior to the start of CT and 24 hours after CT. Suspicious lesions were identified and measured with a fat-suppressed high-resolution 3D FLASH image (Gd-TPA, 0.1 mmol/kg). Concentrations of tCho were quantified [3]. Each scan was interpreted by evaluation of lesion size, architecture, signal intensity, and tCho.

Results: Twenty-six out of 69 patients had infiltrative ductal carcinoma, 10/69 patients had infiltrative lobular carcinoma, 3/69 patients had ductal carcinoma *in situ*, 1/69 patients had lobular carcinoma *in situ*, and 29/69 patients were found to have benign breast lesions. Eight patients have been through CT. Tumor response was seen in six patients. MRS could detect decreased [tCho] within 24 hours after CT. In the six patients with decreased [tCho] at 24 hours, 100% showed diminished tumor size measured by MRI after 9 weeks of CT. However, the two patients with sustained or elevated [tCho] at 24 hours failed to have response to CT.

Conclusion: Based on these results, we expect that the addition of MRS to MRI will provide a noninvasive technique for determining whether a breast abnormality is benign or malignant. Furthermore, the [tCho] measured at 24 hours appears to predict response to CT.

References

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2. Katz-Brull R, *et al.*: *J Natl Cancer Inst* 2002, **94:**1197-1203.
3. Bolan PJ, *et al.*: *Magn Reson Med* 2003, **50:**1134-1143.

16 Scintimammographic findings with ^{99m}Tc-(V)DMSA and ^{99m}Tc-MIBI in usual-type ductal epithelial hyperplasia (HUT) and apocrine metaplasia (AM) of the breast, in relation with the cell proliferation index (Ki-67) and the presence of estrogen receptors (ERs)

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Breast Cancer Res 2004, **6(Suppl 1)**:P16 (DOI 10.1186/bcr835)

Aim: The aim of this study was to assess retrospectively the ability of ^{99m}Tc-(V)DMSA and ^{99m}Tc-MIBI to recognize benign breast lesions such as HUT and AM, with elevated proliferative activity at different ER status, which have different probabilities to progress into invasive tumors.

Patients and methods: Twenty-one patients with histologically confirmed HUT and/or AM were submitted preoperatively to (V)DMSA and/or MIBI scintimammography, 10 min and 60 min after administration of 925–1100 MBq each radiotracer. Immunohistochemical staining was performed using the avidin–biotin method to determine Ki-67 and ER positivity. Lesion to background ratios (L/B) were calculated and compared (*t* test) with Ki-67 and ER values in HUT and AM with both tracers (Ki-67 > 3% and ER > 15% were considered positive).

Results: Histology demonstrated HUT in 11 patients and AM in 10 patients. Mean L/B ratios for (V)DMSA and MIBI in HUT and AM were 1.71 ± 0.44 (range 1.0–2.6), 1.2 ± 0.23 (range 1.0–1.6), 1.1 ± 0.06 (range 1.0–1.2) and 1.15 ± 0.05 (range 1.05–1.2), respectively. Ki-67 for HUT ranged from 1 to 20% (mean ± standard deviation [SD], 6.25 ± 5.7) and ER from 0 to 90% (mean ± SD, 43.8 ± 5.7). Ki-67 for AM ranged from 1 to 15% (mean ± SD, 4.83 ± 4.7). In patients with HUT and Ki-67 <3% the mean L/B (V)DMSA ratio was 1.13 ± 0.10, while in those with HUT and Ki-67 >3% it was 1.89 ± 0.35 ($P = 0.0012$). In patients with HUT and ER <15% the mean (V)DMSA L/B ratio was 1.66 ± 0.47, while in ER >15% it was 1.73 ± 0.43 (not statistically different). L/B MIBI ratios were not significantly different in the groups with higher or lower Ki-67 and ER values in patients with HUT (1.48 ± 0.45 for Ki-67 <3% and 1.25 ± 0.15 for Ki-67 >3%). AM did not show any statistical difference between L/B (V)DMSA and MIBI in the groups with higher and lower Ki-67 and ER expression.

Conclusion: (V)DMSA uptake in HUT seems to be related to Ki-67 activity and could be a useful indicator of the probability of these lesions to progress to atypical hyperplasia, ductal carcinoma *in situ* or invasive tumors.

17 The use of bilateral whole breast ultrasound to identify multifocal disease in newly diagnosed breast cancer

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Breast Cancer Res 2004, **6(Suppl 1)**:P17 (DOI 10.1186/bcr836)

The aim of this study was to evaluate the contribution of bilateral breast ultrasound in the management of women with newly diagnosed primary breast cancer.

One hundred and two women presenting with breast cancer over a 6-month period underwent bilateral breast ultrasound. Data were collected on pathology, size, invasive status, multifocality and surgical outcome. These patients were compared with 104 patients presenting over a 6-month period, 1 year previously, who had undergone targeted breast ultrasound.

Thirty-five (34%) of the study patients had multifocal/multicentric disease diagnosed compared with 18 (15%) of the control patients. The multiple cancers in the study group were more likely to be diagnosed by ultrasound, and were more likely to be multicentric than in the control population. Two contralateral cancers were identified by ultrasound alone in the study population. The diagnosis of multifocality changed the proposed management at surgical review in 8% (95% confidence interval: 4–14%).

18 Can high-frequency ultrasound predict metastatic lymph nodes in patients with invasive breast cancer?

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Breast Cancer Res 2004, **6(Suppl 1)**:P18 (DOI 10.1186/bcr837)

Aim: To determine whether high-frequency ultrasound can predict the presence of metastatic axillary lymph nodes, with a high specificity and positive predictive value, in patients with invasive breast cancer. The clinical aim is to identify patients with axillary disease requiring surgery who would not normally, on clinical grounds, have an axillary dissection, so potentially improving outcome and survival rates.

Materials and methods: The ipsilateral and contralateral axillae of 42 consecutive patients with invasive breast cancer were scanned prior to treatment using a B-mode frequency of 13 MHz and a Power Doppler frequency of 7 MHz. The presence or absence of an echogenic centre for each lymph node detected was recorded, and measurements were also taken to determine the L/S ratio and the widest and narrowest part of the cortex. Power Doppler was also used to determine vascularity. The contralateral axilla was used as a control for each patient.

Results: In this study of patients with invasive breast cancer, ipsilateral lymph nodes with a cortical bulge ≥ 3 mm and/or at least two lymph nodes with absent echogenic centres indicated the presence of metastatic axillary lymph nodes (10 patients). The sensitivity and specificity were 52.6% and 100%, respectively, positive and negative predictive values were 100% and 71.9%, respectively, the P value was 0.001 and the Kappa score was 0.55.

Conclusion: This would indicate that high-frequency ultrasound can be used to accurately predict metastatic lymph nodes in a proportion of patients with invasive breast cancer, which may alter patient management.

19 Trends and predictors of size and grade for ductal carcinoma *in situ* (DCIS) in BreastScreen Victoria

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Breast Cancer Res 2004, **6(Suppl 1)**:P19 (DOI 10.1186/bcr838)

Previous studies have examined predictors, such as hormone replacement therapy (HRT) use, of size and grade of invasive breast cancer, but little is known about factors that influence prognostic features of DCIS. We evaluated factors associated with size and grade of DCIS in a large screening programme, BreastScreen Victoria.

A total of 1127 women were diagnosed with DCIS and 5301 with invasive breast cancer in BreastScreen Victoria between 1993 and 2000. We used multiple linear regression to evaluate predictors of size and multinomial logistic regression to evaluate predictors of grade.

The ratio of DCIS to invasive tumours decreased with age but did not differ by time since the last screen. Older age (over 70 years) was associated with smaller DCIS size and better differentiated tumours ($P = 0.05$) compared with women aged 50–69 years. A longer screening interval was associated with larger DCIS tumours ($P = 0.01$) but was not associated with grade of DCIS. There was a borderline significant association between current HRT use and decreased risk of high-grade DCIS lesions ($P = 0.07$) in univariate analyses, but this disappeared after adjustment for size and histology.

There are important differences between predictors of DCIS and invasive cancer. In contrast to invasive cancer, HRT is not associated with size or grade of DCIS.

20 Screen-detected lobular carcinoma *in situ* (LCIS) of the breast: 166 cases within the National Health Service Breast Screening Programme (NHSBSP)

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Breast Cancer Res 2004, **6(Suppl 1)**:P20 (DOI 10.1186/bcr839)

Background: LCIS is classically an incidental finding on breast biopsy with no positive mammographic features. However, screening has identified a small number of cases of pure LCIS.

Aim: To review cases of screen-detected LCIS within the NHSBSP programme since its inception.

Methods: Cases of pure LCIS were identified via Quality Assurance offices and screening centres. Mammograms and pathology were reviewed and recurrence/survival data obtained. New immunohistochemistry was performed on the available pathology blocks.

Results: One hundred and sixty-six cases of screen-detected LCIS were identified in 20 centres since 1988. One hundred and seven (64%) presented with calcifications on mammography, 25 (15%) with a mass lesion and 34 (21%) with distortion or asymmetry. The preoperative diagnosis rate with core biopsy was 28/84 = 33%.

Of 106 patients in which follow-up was available to date, six went on to get an invasive cancer at a median time of 60 months; four of these were unilateral.

Conclusions: Screen-detected LCIS is a rare but important lesion. Preoperative diagnosis is difficult. Invasive recurrence is 1% per year of follow-up.

21 Radiological and histological features of mammography screen-detected lesions having undergone benign surgical excision

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Breast Cancer Res 2004, **6(Suppl 1)**:P21 (DOI 10.1186/bcr840)

Aim: The development of modern image breast-guided biopsy techniques including core biopsy and vacuum-assisted core biopsy has improved the nonoperative diagnosis for most screening mammography-detected lesions, leading to a decrease in benign surgery. The aim is to describe the radiology and histology of benign screen-detected lesions requiring surgical excision in our practice.

Method: From April 1998 to March 2003, 155,621 women were screened in the South East London Breast Screening Programme, 8836 women were assessed (5.7%), and 182 benign lesions were surgically removed (0.1% of women screened). Radiological and histological features were recorded on a database.

Results: The primary histological diagnosis was: fibrocystic change (FCC) (26%), radial scar/complex sclerosing lesion (CSL) (24%), fibroadenoma (FA) (14%), papilloma (11%), atypical ductal hyperplasia (ADH) (7%), and miscellaneous other (15%).

The mammography features of benign lesions excised were well-defined mass (38%), microcalcifications (28%), stellate distortion (28%), asymmetry density (3%), and 4% other signs.

The commonest histology for each mammography sign was: microcalcifications, FCC (40%), papilloma (11%), FA (9%), ADH (8%), CSL (6%); well-defined mass, FA (28%), FCC (25%), papilloma (18%), CSL (10%); and architectural distortion, CSL/radial scar (78%), only 16% in FCC with 6% in FA.

Conclusion: This study confirms that modern breast biopsy techniques decrease the need for surgery for benign lesions, particularly microcalcifications due to FCC. A further decrease in the need for surgical biopsy may be anticipated as techniques improve and data showing the effectiveness of nonoperative diagnosis of such as CSL/radial scar and papilloma become available.

22 How spiculation affects the likelihood of malignancy in screen-detected masses: a review of 974 masses excised in the first 8 years of the East Sussex, Brighton & Hove Breast Screening Service

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Background: The presence of spiculation arising from a mass detected at mammography makes malignancy a probable diagnosis. This is confirmed by this review of the first 8 years of screening in East Sussex where only 3.6% of masses with spiculation were benign at excision (24 out of 668), compared with 33.3% of masses without spiculation (102 out of 306).

Methods and results: The mammographic appearances of screen-detected lesions were prospectively recorded at the time of assessment. Features recorded for masses were the presence or absence of spiculation and microcalcification. Those undergoing excision were entered onto the former South East Thames Screening database. The mammographic features and type of lesion are presented in Table 1.

Most of these lesions were excised during the era when we performed fine needle aspiration rather than the core biopsies we use today and it was our policy to excise all mass lesions showing spiculation. The very small number of benign surgical biopsies in this group shows that the policy was justified.

Table 1

Mammographic feature	Number of benign lesions (%)	Number of *in situ* cancers (%)	Number of invasive cancers (%)	Total
Mass with spiculation and microcalcalcification	7 (4.3)	4 (2.4)	153 (93.3)	164
Mass with spiculation and no microcalcification	17 (3.4)	4 (0.8)	483 (95.8)	504
Total with spiculation	24 (3.6)	8 (1.2)	636 (95.2)	668
Mass without spiculation but with microcalcification	27 (30)	11 (12.2)	52 (57.8)	90
Mass without spiculation or microcalcification	75 (34.7)	12 (5.6)	129 (59.7)	216
Total without spiculation	102 (33.3)	23 (7.5)	181 (59.2)	306

23 Ductal carcinoma *in situ* (DCIS): are we overdetecting it?

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DCIS constitutes approximately one-quarter of screen-detected cancer. The proportion of screen-detected cancer that is DCIS decreases with the age of the screening population. Whether detecting DCIS at mammographic screening is of benefit depends on the natural history of the DCIS detected at screening and whether DCIS detection enables the detection of invasive foci already present within DCIS lesions.

The natural history of DCIS varies according to the grade of the DCIS detected. The natural history of low grade DCIS is that approximately 60% of lesions will become invasive at 40 years

follow-up. The natural history of high grade DCIS derived from local recurrence rates within high grade DCIS lesions, which have been inadequately resected and not given radiotherapy, suggests an invasive risk of at least 50% at 7 years follow-up. Given the average life expectancy of women with screen-detected DCIS is 25 years, this suggests high grade DCIS is an obligate precursor of invasive disease. There is a strong correlation between the grading of invasive cancer and the grade of DCIS from which it arose. This suggests that approximately 50% of low grade DCIS detected at screening will represent overdiagnosis while overdiagnosis of high grade DCIS would be rare. The natural history of intermediate grade DCIS is as yet unknown. Only 15% of screen-detected DCIS is low grade, suggesting that overdiagnosis is uncommon.

Approximately 60% of screen-detected DCIS is high grade and in the vast majority of these patients adequate treatment will be preventing the occurrence of high grade invasive breast cancer. Approximately one-third of malignant calcification clusters detected at screening mammography already has an invasive focus. These invasive foci are usually small and high grade. Data gathered from all the units in the National Health Service Breast Screening Programme indicate a strong correlation between the detection of DCIS and the detection of small invasive cancers. These data indicate that for every two cases of DCIS detected, one case of a small invasive cancer is also detected. These data indicate that DCIS detection within a mammographic screening programme prevents the occurrence of high grade invasive cancer and aides the detection of small invasive cancers at a size where treatment can be successful. Overdiagnosis will occur in approximately one-half of the cases of low grade DCIS detected. This represents approximately 2% of screen-detected lesions. If one assumes the natural history of intermediate grade DCIS is intermediate between low and high grade disease then overdiagnosis of DCIS within a screening programme may represent 3% of screen-detected lesions.

24 Ductal carcinoma *in situ* (DCIS): are we overtreating it?

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DCIS continues to increase in incidence as the number of women invited to population breast screening programmes increases. This means that more women are treated every year for DCIS. More women diagnosed with DCIS currently receive some form of treatment and the issue is whether this treatment is necessary and appropriate.

There are few data on the natural history of untreated DCIS. Studies from Nashville by Page [1] show 28% of patients with low grade DCIS develop invasive disease by 6 years and 40% have developed invasive disease by 30 years. Data from Van Nuys [2] suggest that the rate of progression in high grade DCIS is much higher, with 60% of women with incompletely excised high grade disease developing progression or invasive cancer by 5 years.

The results of studies on treatment of DCIS can be summarised as follows:

- Excision alone is associated with a high rate of local recurrence in approximately 3.8% per year, of which 1.6% per year is invasive disease.
- Radiotherapy reduces the recurrence rate in the progression to invasive cancer by between 50 and 60%.
- Recurrence rates are lower when radiotherapy is given to patients whose lesion is completely excised with clear margins. The evidence that wider margins is associated with better local control rates does not stand up to scrutiny. Surgeons in the UK are divided as to what they consider to be an adequate clear margin width.
- Tamoxifen reduces recurrence rates in oestrogen receptor-positive DCIS but not oestrogen receptor-negative DCIS.
- No patients with localised DCIS should have axillary surgery.

As the numbers of patients with DCIS increases, so the number of women being treated by breast-conserving surgery and mastectomy increases. The challenge is to limit the surgery so as to reduce morbidity and select those patients who will have most to gain from radiotherapy and tamoxifen.

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25 The Sloane Project

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Ductal carcinoma *in situ* (DCIS) is a disease discovered by screening. Fifteen years after the introduction of the UK Breast Screening Programme we have belatedly recognized that it is a fascinating disease about which we, in reality, know very little.

Early trials in DCIS have recruited small numbers and have not delivered definitive results. Nevertheless, thanks to improvements in radiology the detection of new DCIS cases has gone up. In 1996/97, 1468 cases of DCIS were

detected; by 2002/03 this had increased to 2416, an increase of 65%.

These numbers represent a significant and as yet untapped resource of data about this group of patients. The aim of the Sloane Project is to audit all screen-detected noninvasive disease.

Over 5 years it should be possible to collect data on over 10,000 patients with noninvasive disease. Data are collected contemporaneously on radiology, pathology and treatment. We aim to audit local recurrence and survival.

With large numbers it should be possible to inform clinicians and thus their patients of the likely risks and benefits of individual treatments.

The Sloane Project does not exclude any screen-detected patient, it actively encourages trial recruitment but its potential is to be the largest audit of noninvasive screen-detected cancer in the world.

In recognition of his seminal contributions to DCIS the project is named after John Sloane. (For details on contributing patients, please contact Karen Clements, Sloane Project Officer. Tel: +44 121 414 7713.)

26 Workforce issues

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The prevention, diagnosis and treatment of breast disease requires an integrated approach to healthcare, and a workforce that is able to function interprofessionally and across the spectrum of healthcare from public health and preventative care to care of patients in the terminal stages of their disease. It is important to remember this when addressing workforce issues, especially when focusing on one section of the workforce community, the radiography workforce.

Changes to the National Breast Screening Programme have necessitated an increase in the size of the workforce to carry out the screening mammograms, and an increase in workforce elsewhere to deal with the subsequent additional demand for further assessment and treatment. This has coincided with a severe shortage of radiographers and radiologists, two key groups in the workforce. This has led to a re-examination of roles and responsibilities of staff and the tentative introduction of the career progression framework for the radiography workforce.

This presentation outlines the career progression framework with particular reference to the National Breast Screening Programme. It identifies key challenges that this has brought; for example, education and training; role boundary blurring; and professional patch protectionism. It will also offer some potential solutions, which, together, should help meet the needs of clients and patients.

27 Two-view mammography: the Welsh experience and overview

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In Wales, population breast screening using mammography, within the National Health Service Breast Screening Programme (NHSBSP), commenced in February 1989. It was gradually rolled out across the Principality over the next 3 years by Breast Test Wales with the prevalent screening round completing in 1995.

From its inception, two-view mammography was the standard for all prevalent round screens in Wales, unlike many other screening programmes that relied on a single view. This resulted in higher than expected cancer detection rates as compared with the Swedish Two County trial and other NHSBSP results. In Wales 9.2 breast cancers per 1000 women screened were found compared with an average of 6.3 per 1000 in the rest of the UK in the prevalent round.

For incident round screens, it was decided that single-view mammography was appropriate. The results were less impressive, with cancer detection dropping to standardised detection ratio values of less than one. There may be several reasons for this anomaly, not least of which is the possibility that more subtle cancers, including those only visible on the cranio-caudal view, had been identified at the prevalent screen and were thus not present to be picked up at subsequent incident rounds.

In 2000, when the National Assembly for Wales made monies available to extend screening up to the age of 70 years, it was decided that, firstly, the programme should revert to two-view screening, but this time for all rounds. The results of these first two-view incident round figures will be presented. There has been an increase in cancer detection of around 39%, similar to that predicted by Blanks and Moss in their studies. The first 18 months of two-view incident round screening increased the cancer detection rate in these women from 5.38 to 7.5 per 1000 screened. This included an increase in the small cancers

detected from 2.30 to 3.30 per 1000. The recall to assessment figures also rose, surprisingly from 3.8% to 4.5%, although the rise has not been sustained more recently. In some areas the first incident two-view round has been completed; data on this will be presented.

It is, however, unlikely that this increase in cancer detection will persist in subsequent incident rounds and a steady state will be reached, but at a higher level of cancer detection than with single-view incident screening.

It is hoped that, in contrast, the interval cancer rate will drop accordingly. Early data on interval cancers will also be presented.

28 Overview of recent changes to the National Health Service Breast Screening Programme (NHSBSP): impact on the service

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Breast Cancer Res 2004, **6(Suppl 1)**:P28 (DOI 10.1186/bcr847)

The NHS Cancer Plan of October 2000 announced two major changes to the NHSBSP. These were the introduction of two views to all screens and the expansion of the programme to include women aged 65–70. These changes together amounted to a 40% increase in workload and were to be introduced by the end of 2003 and 2004, respectively.

In order to cope with this expansion, new ways of working were developed. Many services already have assistant practitioners taking mammograms and radiographers undertaking elements of advanced practice, some of the latter are operating fully as advanced practitioners. A new computer system has been introduced and there has been a major re-equipping of the service.

All but a handful of screening programmes are now taking two views at each screen, and four out of 10 have expanded to include 70 year olds. With the exception of only a few, the rest should all be working to the new target age range by the end of this year.

Round length is now the most vulnerable area of the screening programme. Services are sometimes struggling to cope with delivering a high-quality expanded programme and maintaining 3-yearly screening.

29 Interim results from the Age Trial

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Since 1991, 160,884 women were randomised in the ratio 1:2 to intervention (annual mammography from age 40 to 41) and control arms. All breast cancers diagnosed in both arms were identified, and subjected to detailed histology review. Predicted deaths from breast cancer up to 10 years from entry were calculated using three different prognostic indices, based on 1287 cases diagnosed before 2000.

There is currently an 8% excess of invasive breast cancers in the intervention arm, but nonsignificant decreases in the rates of cancers $\geq$20 mm and node-positive cancers. The ratio of predicted deaths in the intervention and control arms, adjusted for the excess diagnosis in the intervention arm, ranges from 0.89 to 0.90, and is borderline significant.

This trial may result in a smaller breast cancer mortality reduction than other trials of women aged under 50, due to inclusion of all women from age 40 with possible lower sensitivity at younger ages. However, the present analysis, based on surrogate outcome measures, relies on several assumptions to overcome potential biases. Firm conclusions must await the analysis of observed mortality from breast cancer.

30 Radiological results of the Age Trial

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Almost 500 cancers occurring within the study arm of the Age Trial have had their radiological features reviewed. The commonest radiological features of screen-detected cancers in this age group are granular microcalcification (28%), spiculate mass (22%), poorly defined mass (20%) and comedo calcification and parenchymal distortion both at 18%. Of the 254 cancers detected at screening that had a previous screen, 52% showed some mammographic feature on the previous screen. The most frequent abnormality in such cases was granular microcalcification 44%, parenchymal deformity 17%

and poorly defined mass 17%. Of the 138 interval cancers reviewed, 30% had abnormalities visible on previous screens. The commonest features present on previous screens were microcalcification, asymmetric density and ill-defined mass.

The radiological features of cancers arising in younger women who are being screened are different to those occurring in older women. Spiculate masses are less common and microcalcification is more common in this age group. Microcalcification is also a common feature of screen-detected cancers visible on previous screens.

False negative interval cancers show a more varied distribution of radiological features, with asymmetric density, parenchymal deformity and microcalcification all being important features.

31 Pathology results from the UK Age Trial

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The UK Age Trial was initiated in 1991 to address the question of whether annual mammography from age 40 years reduces mortality from breast cancer and by what percentage. At present, only surrogate end points generated by pathology review of cancers can be used for a preliminary estimate of mortality/survival benefit for the study arm. All cases of breast cancer in the appropriate age range were systematically identified and relevant material retrieved for centralised, blinded review by a panel of three pathologists following classification principles outlined in the UK Guidelines. The total number of cancers identified in the Trial population up to 31 December 1999 was 1288.

There was a high proportion of special types in incidence and interval cancers but the explanation in each set differs; for incidence cases the preponderance is for tubular cancers, while for interval cases it is lobular cancers. For grade, incidence screens yielded the highest proportion of grade I and a low grade III, whereas interval cancers showed the converse, with low grade I and high grade III proportions. For node status, the highest negative proportion was found for incidence screens and the lowest was seen in 'never attended' cases. These features provide clear confirmation of the length bias influence anticipated for the screened subpopulations, but they are not fully informative for screening effects or for understanding cancer natural history.

32 Chemoprevention for breast cancer: current status

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Breast Cancer Res 2004, **6(Suppl 1)**:P32 (DOI 10.1186/bcr851)

33 Digital imaging: Digital Mammography Imaging Screening Trial Project

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The Digital Mammography Imaging Screening Trial was formed to determine whether digital mammography could detect breast cancer as well as, or better than, film mammography. Since 2001, 35 facilities helped enrol the 49,528 patients in the US and Canada. Each study participant had a digital mammogram and a film examination. A follow-up mammogram was obtained 1 year after the initial study to determine breast health status. The study completed its accrual in November 2003. One-year follow up mammograms are currently being performed. Over the next 18 months 84 radiologists will interpret soft copy, digital hard copy and film images. Parameters to be analyzed include: diagnostic accuracy of digital monitor images, effect of breast cancer prevalence on the radiologist's interpretation, effect of breast density on diagnostic accuracy of digital and film mammography, and the diagnostic accuracy of different digital and film units.

Each facility was required to meet strict quality control standards for both digital and film screen mammography. In addition, each facility was inspected to ensure proper record keeping and documentation. The results from this study should prove beneficial to breast cancer diagnosis and treatment.

34 Digital imaging: technical developments and UK perspective

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A remarkable variety of designs for full-field digital mammography have been developed. Computed radiography systems, using laser-stimulated photo-stimulable phosphor technology, which are widely used for general radiography, are increasingly also used for mammography. Computed radiography has received a new lease of life with the introduction of dedicated dual reading technology at 50 µm pixel size. Other designs have integrated digital detector systems where the detector and read-out mechanism are built into the breast platform. The quality of display monitors is regarded as crucial and dual cathode ray tube displays with 2000 × 2500 resolution are becoming standard, but it is likely that high-resolution liquid crystal displays will supplant these. Although most systems demonstrate an image quality that is superior to existing film screens, some are inferior. New standards are being introduced for image quality to verify that new digital systems have a performance that is at least as good as current systems. While digital systems may be readily introduced into a symptomatic role, their use in screening is more problematic because of the high throughput required for both acquisition and display. A number of informal trials of digital systems in screening and assessment environments are taking place in the UK.

35 Computer-aided detection (CAD): the case for

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In any discussion regarding the necessity for CAD, the ultimate goals of a screening programme must be taken into consideration balanced against the cost of instituting the programme. Double reading has been shown to increase sensitivity by as much as 15%. However, the cost no matter the method is formidable. CAD, on the other hand, while initially costly, has been shown to increase the sensitivity by as much as 23%. This increase in sensitivity is reason enough to use CAD, but must be evaluated in the context of effect on positive predictive value and recall rates. Our clinic first viewed CAD with the same concerns. Our studies to date indicate no statistically significant change in positive predictive value or recall rate. Despite an independent double-blinded double read, CAD increased sensitivity by 7%. Some studies have shown that increased sensitivity with CAD is due to ductal carcinoma *in situ* detection, but this was not shown in our prospective study. In our group of cancers, 87% were stage 0 or stage 1 and 77% were minimal cancers (<10 mm invasive or any size ductal carcinoma *in situ*). However, the cancers that the double read missed and CAD prompted were all invasive with only 57% minimal disease.

36 Computer-aided detection (CAD): the case against

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Breast Cancer Res 2004, **6(Suppl 1)**:P36 (DOI 10.1186/bcr855)

CAD places prompts to alert readers to potential lesions. Readers can decide whether to initiate further assessment. Currently, commercially available CAD systems are highly sensitive and will prompt 94% of detected cancers (98.4% microcalcifications, 89% masses). Prompt rates on missed cancers are lower but the majority are prompted (52–77%). A number of published evaluations of CAD benefit extrapolate from these rates. They assume that readers will respond appropriately to every correct prompt and initiate recall. Studies *in vitro* and in real life show variable reader response, with increases in cancer detection ranging from 0% to 22%. There is lower specificity with one to two false prompts per case. In UK screening, readers will dismiss over 1000 false prompts for every true prompt, which should change their outcome decision. This makes discrimination difficult. When investigating missed cancers we have found readers are more likely to dismiss than act on true prompts. In addition, CAD increases reading time and can increase recall rate, thus increasing cost. This is offset in the US by higher reimbursement for CAD reading but would be cost increasing in the UK.

CAD technology is improving and may shortly be beneficial but at present its role in the UK is unproven.

37 Sonographic assessment of extent and aggressiveness of malignant breast disease

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Breast Cancer Res 2004, **6(Suppl 1)**:P37 (DOI 10.1186/bcr856)

While contrast enhanced magnetic resonance imaging (MRI) is generally considered the modality of choice for staging malignant breast disease and PET/CT is considered the modality of choice for staging distant spread, ultrasound (US) can also be used to assess the local extent of malignant breast disease in many patients. Most patients will undergo breast sonography prior to breast MRI or PET/CT. Thus, US offers us our first chance to determine the local extent of disease in many cases. US is good enough at 'staging' that in any patient with a solid nodule characterized as BIRADS 4 or BIRADS 5 we routinely perform whole breast US and assess the axillary lymph nodes during the initial sonogram or immediately prior to performing US-guided biopsy of the index lesion.

US staging involves determining the maximum diameter of the index lesion, assessing for multifocal and multicentric disease, and looking for the presence of extensive intraductal components (EIC). Regional lymph nodes can also be assessed sonographically at the same time that the suspicious index solid nodule and ipsilateral breast are evaluated. US-detected secondary and tertiary lesions can, and should, be 'mapped out' with US-guided biopsies.

Accurate US staging leads to the appropriate type of extirpative surgery, minimizes the number of surgeries necessary to rid the patient of disease, and can minimize the risk of local recurrence. In fact, 'local recurrence' is almost always residual unresected disease that was not recognized preoperatively or intraoperatively by the surgeon. It can also obviate staging MRI and sentinel node procedures in some cases.

We then place nine individual suspicious findings into three categories: 'hard', 'soft', and 'mixed' suspicious findings. 'Hard' findings suggest the presence of invasion, and include angular margins, spiculation, and acoustic shadowing. 'Soft' findings suggest the presence of ductal carcinoma *in situ* (DCIS) components, and include duct extension, branch pattern, calcifications, and most cases of microlobulation. It is important to include soft findings in the sonographic algorithm because they improve the sensitivity for pure DCIS, but also because they help us to better assess the true extent of lesions that contain both invasive and intraductal components. Most invasive ductal carcinomas contain DCIS components, which frequently lie in the periphery and contribute to the surface characteristics and shape of the lesion. 'Mixed' findings are not specific and can be seen with either invasive or DCIS components of the lesion, and include taller-than-wide (antiparallel) shape, hypoechogenicity, and a minority of microlobulations.

The most basic prognostic feature of a malignant lesion is its maximum diameter. There are two different maximum diameters—the prognostic diameter used in determining the TNM stage and the surgical diameter necessary to completely remove the lesion. The prognostic diameter is the maximum diameter of the invasive component of the tumor, and is represented sonographically by the largest part of the lesion than manifests hard sonographic findings. The resection diameter includes both invasive and DCIS components of the tumor and is represented sonographically by the greatest length of combined hard and soft findings in the lesion.

Multifocal invasive carcinoma usually represents separate foci of invasion in a single malignant lesion that are connected by DCIS components of the lesion. By scanning parallel to the long axis of the mammary ducts in the region of a suspicious breast nodule, we are frequently able to show 'bridges' of DCIS connecting the foci of invasion.

EIC increase the likelihood of local recurrence in patients who undergo breast-conserving therapy. Prominent 'soft' findings suggest the presence of EIC.

Certain suspicious sonographic features correlate with the histologic grade of the lesion or with the nuclear grade of the DCIS components of invasive ductal carcinomas. The presence of enhanced through-transmission deep to a suspicious solid nodule more than doubles risks that the lesion is high grade. Shadowing favors the lesion being low or intermediate grade. The thicker the ill-defined echogenic halo relative to the size of the hypoechoic central nidus, the more likely the lesion is to be low grade. Circumscribed malignant nodules that are surrounded by a thin echogenic capsule are more likely to be high-grade invasive ductal carcinomas or special-type tumors such as colloid or medullary. Large microlobulations and branch pattern suggest a high-grade lesion, intermediate-sized microlobulations and branch pattern suggest an intermediate-grade lesion, and very small microlobulations suggest the presence of a low-grade lesion.

Once we have completely evaluated the breast to look for multifocal and multicentric disease and EIC, we proceed to evaluate the axillary lymph nodes. If abnormal lymph nodes are found, we perform US-guided biopsy of the lymph node. If the biopsy is positive for metastatic disease, the sentinel lymph node procedure becomes unnecessary and the patient proceeds straight to axillary dissection. If the biopsy is negative for metastatic disease, the patient undergoes the sentinel node procedure as originally planned. There is a distinct advantage to this pattern of sonographic evaluation. The sentinel node procedure is not perfect. False negative sentinel node procedures occur in a small percentage of patients. In such cases, the cause of failure is 'tumor damming'. Metastases to the sentinel node

block the normal lymphatic drainage through the sentinel node, causing it to go through collaterals to a higher node that may still be histologically negative. Sentinel nodes that are so grossly filled with tumor that they alter the normal lymphatic drainage pattern are easily identified as being abnormal by sonography and can easily be targeted for US-guided biopsy.

38 Phantom experiments for measuring elasticity of breast cancer by the echo technique

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Breast cancer is more stiff compared with benign lesions. The aim of the experiment is to measure the elasticity by pressing the breast with a water bag and measuring the shape change by the echo technique. The ultrasound frequency was 8 MHz. Two kinds of phantoms were created. One is made of silicone rubber 50 mm in thickness and inside is a polymethylmethacrylate (PMMA) cylinder of diameter 20 mm. The PMMA cylinder is mocking the cancer and is placed with the surface at 10 mm and 20 mm depths from each silicone rubber surface. Another phantom is made of gelatine of 30 weight percent to water instead of silicone rubber. The phantoms were placed between two PMMA plates and pressed by a balloon filled with water, which is connected to a vessel by a rubber tube. The height of the vessel can be adjusted to change the pressure of the balloon. The silicone rubber phantom was too hard to be deformed by water pressure. The gelatine phantom was deformed around the PMMA cylinder by water pressure of up to 3.4 kPa. The gelatine surface was deformed by gravity without water pressure. Apparent differences of gelatine surface deformation depending on different water pressure were confirmed from the echogram thus obtained.

39 The management of X-ray quality control data in mammography applications: an information technology approach to solving the problem

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Mammographic equipment quality control procedures require that upwards of 35 items of data are recorded from each of 31 mammographic X-ray units per week, for which the Integrated Radiological Services provides medical physics support. The data are garnered from four main quality assurance (QA) areas; automatic exposure control monitoring, tube output data, image quality assessment and film processor monitoring (sensitometry). This adds up to some 1085 items per week or over 56,000 items per year. These data are collected by QA radiographers in both screening and symptomatic units on paper records, which are then sent to the Integrated Radiological Services where the data are input to a central database for storage and analysis. During a typical year this would require 50 man-days of medical physics input to be devoted to this task. An information technology-driven database system has been in use for some time to facilitate the central storage, analysis and management of these data. This paper reports on the implementation of a data interface, using personal digital assistant technology, between the user (QA radiographer) and the data management system. This personal digital assistant approach streamlines the data entry to the management system and the transfer of data to the central assessment facility.

40 The impact of digital stereotactic devices on examination times

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One of the perceived benefits of digital stereotactic devices over film-based ones is a reduction in examination time. However, there is a lack of published evidence to demonstrate this. A study was undertaken to compare the duration of examinations by recording the timing of events (including start and end times) during routine use of film-based and digital devices. The median times were compared using the Mann–Whitney U test.

The median times for film-based systems were 35 min for core biopsies ($n = 48$), 26 min for fine needle aspirations ($n = 64$) and 22 min for wire localisations ($n = 24$). The times for digital systems were 25 min for core biopsies ($n = 92$), 19 min for fine needle aspirations ($n = 59$) and 15 min for wire localisations ($n = 56$). Thus digital systems reduced the examination time by approximately 30%, offering a potential increase in patient throughput. The total compression time was reduced by 3–7 min; this may improve patient comfort. The time between applying compression and inserting the first needle was reduced by 4–6 min; this may improve positional accuracy by lessening the chance of patient movement. All differences were statistically significant.

This study demonstrates that digital systems offer a real reduction in examination time.

41 Compression/encryption technology applied to Dicom/digitised mammography

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Breast Cancer Res 2004, **6(Suppl 1)**:P41 (DOI 10.1186/bcr860)

There is an increasing need for teleradiology services that enable images to be sent to other centres for further opinion, plus the collation of research data with images from many different medical institutions. Mammography has specific and demanding requirements, and in testing a new Dicom compression and encryption tool it was apparent that it can cope with very large files such as a set of four Dicom mammograms. The 256 bit (32 characters) encryption provides appropriate data protection for transmission of the compressed images, while the original Dicom images remain unchanged on the host system. Four sets of Dicom mammograms were compressed and prepared on disc as a series using the originals in one set, and varying levels of compression to six other series. These were viewed by various consultants on a personal computer to determine whether the image quality is acceptable for diagnosis, and evaluated on a scale of 1–5. A 34 MB patient set can be compressed to fewer than 300 kB without losing data. A separate analysis of all pixels in the image for both original and compressed formats give an indication of 'Lossless' and 'Lossy' 1/3 levels. The applications of this technology will be considered.

42 Image-guided interventional procedures of the breast: the development and delivery of a postgraduate programme of study from an academic and clinical perspective

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Breast Cancer Res 2004, **6(Suppl 1)**:P42 (DOI 10.1186/bcr861)

It is acknowledged that advanced practitioners [1] can, if suitably trained, undertake interventional procedures of the breast under mammographic/ultrasound control.

While the idea of mammographers/ultrasonographers undertaking interventional procedures remains controversial, it is established practice in a small number of centres, through 'in-house' training [2]. However, some concern has been expressed at the nontransferability of the skills acquired by 'in-house' training, and the need for formal academic input of required underpinning knowledge and accreditation of competencies is now recognised [3]. This can only be achieved by academics and clinical specialists working in collaboration [1].

This paper discusses the problems associated with the development and delivery of such a postgraduate programme from an academic and clinical perspective.

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43 Breast compression revisited

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Breast Cancer Res 2004, **6(Suppl 1)**:P43 (DOI 10.1186/bcr862)

Introduction: Breast compression is essential in mammography to reduce breast thickness. Breast thickness reduction reduces the radiation dose and increases the image quality. Breast compression also unfortunately causes discomfort to many women and may deter them from attending for breast screening by mammography. It is essential, therefore, that an optimum amount of compression is applied to minimise breast thickness. Current protocols suggest that breast compression should be applied until physical changes to the breast are observed. Two studies were conducted to investigate the relationship between applied compression force and breast thickness reduction.

Methods: Study 1 investigated changes in breast thickness when applied breast compression was reduced, while study 2 compared the compression force and resultant breast thickness recorded clinically with that recorded under experimental conditions.

Results: The results suggest that applying compression does not ensure breast thickness reduction and observing physical changes does not guarantee that breast thickness has been minimised.

Discussion: The protocols for the applying compression must be changed to emphasise the need for minimising breast thickness. Mammography machine digital displays should be revised.

Conclusion: The goal of mammographic practice must be to minimise breast thickness while acknowledging the potential for discomfort to be experienced.

44 Cysts: are they always benign?

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Breast Cancer Res 2004, **6(Suppl 1)**:P44 (DOI 10.1186/bcr863)

Introduction: We present here four cases of atypical cysts. Cysts are one of the commonest benign lumps seen in a breast clinic. Rarely cysts can show some atypical features, on clinical assessment or on ultrasound.

Triple assessment: The patients were seen in the symptomatic clinic and had a triple assessment according to local protocol. Clinically all had a well-defined smooth lump suggestive of a benign lump, probably a cyst, but the ultrasound in these four patients showed atypical features and was graded as U3 (mammogram was R2). The 27 year old had internal echoes on ultrasound and aspiration was slightly blood stained. Cytology was reported as c3. The cyst rapidly re-accumulated in 3–4 weeks and was re-aspirated and was again blood stained. The other three patients had an ultrasound picture suggestive of a small pappilomatous lesion within the cyst, and guided aspiration revealed suspicious cells. All patients underwent excision of the lump, and the 27 year old had invasive carcinoma and the other three patients had intracystic carcinoma.

Discussion and conclusion: Atypical features on ultrasound in cysts need further investigation. Although cysts are very common benign problems they would need investigation if there were atypical features clinically or on ultrasound.

45 The amalgamation of two breast imaging units in Leeds

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Breast Cancer Res 2004, **6(Suppl 1)**:P45 (DOI 10.1186/bcr864)

Within the United Leeds Teaching Hospitals Trust there are two main breast imaging units providing symptomatic breast services. They provide a facility for two different teams of breast surgeons and historically operate with some differences in protocols.

There are now plans for the reconfiguration of the breast service within the United Leeds Teaching Hospital, which is hopefully to take place early in 2005, with the amalgamation of the two breast imaging units on one site. Prior to this, many changes are required for the merge to be successful.

The proposal for this proffered poster is to outline the plan for the amalgamation of the differing protocols. We aim to identify some of the major differences, outline the method of change in practice through the development of new joint protocols and determine implementation pathways

46 The four-tier system: the ups and downs of getting there

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Breast Cancer Res 2004, **6(Suppl 1)**:P46 (DOI 10.1186/bcr865)

This poster will describe the pathway the South Essex Breast Screening Service/Southend Breast Unit took to introduce the radiographers' four-tier system. This will be set out as a board game of snakes and ladders highlighting the successes and setbacks we encountered, and how we started, recruited staff, trained and now use their training. Finally we show the way that the department has grown into a learning culture with all roles increasing their continuing professional development.

47 The road to ISO 9001:2000

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Breast Cancer Res 2004, **6(Suppl 1)**:P47 (DOI 10.1186/bcr866)

The Breast Imaging Unit at York Hospital NHS Trust is the base for both the North Yorkshire Breast Screening Service and the local Symptomatic Breast Imaging Service.

In compliance with National Health Service Breast Screening Programme guidelines a quality management system has been in place for many years, but as a unit we felt that we could

improve the existing quality management system while at the same time improving the delivery of service and care to our clients, patients and partners.

In order to do this we evaluated different management systems and came to the conclusion that our way forward was to try to develop a system that would stand up to the rigorous standards of ISO9001:2000.

It was a challenge. This poster outlines those challenges, the hurdles, and the changes to our unit while we travelled the road to ISO 9001:2000 accreditation.

48 Are you getting in on the Act?

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Breast Cancer Res 2004, **6(Suppl 1)**:P48 (DOI 10.1186/bcr867)

The 'Social Model' approach to disability sees the problem as barriers posed by society, rather than the person's condition. This approach empowers disabled people to challenge society to remove these barriers, and to enable them equal opportunities.

The Disability Discrimination Act is designed to prevent disabled people being unfairly treated. Since its introduction in December 1996, attitudes and treatment of disabled people have been radically altered. Part of the Act states that any service provider has a duty to make 'reasonable' adjustments to its service in order to ensure that a disabled user is not at a disadvantage to a nondisabled user.

Since October 1999, service providers have been expected to anticipate what help different groups of disabled people may require in order to access their service, and to take 'reasonable' steps to provide the necessary help. The North Yorkshire Breast Screening Service has undertaken an 'inclusive approach' to the service it provides.

This poster aims to explore attitudes towards disability, and demonstrate how the Disability Discrimination Act has been successfully integrated into the working practices of North Yorkshire Breast Screening Services.

49 Equity of access to breast and cervical screening for women with learning disabilities

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Breast Cancer Res 2004, **6(Suppl 1)**:P49 (DOI 10.1186/bcr868)

This poster presentation pictorially depicts the evolution of a local project that aims to enable women with learning disabilities equity of access to breast and cervical screening. It demonstrates that different National Health Service Trusts can work in partnership to promote access to screening services for women with learning disabilities and shows how networking and joint planning can result in the development of strategies to overcome possible barriers. The poster presentation focuses on the facilitation of an ongoing training programme for carers and highlights some individual projects that have been initiated by participants. The overall theme of the project is that women with a learning disability should receive a positive health message, regardless of whether or not they accept or decline screening.

50 Women's experiences of mammography within the West Midlands Breast Screening Programme

J Baker, E O'Sullivan, O Kearins
West Midlands Cancer Intelligence Unit, Birmingham, UK
Breast Cancer Res 2004, **6(Suppl 1)**:P50 (DOI 10.1186/bcr869)

The West Midlands QA Reference Centre has developed a tool to evaluate client satisfaction within breast screening. The survey, which has been running for 4 years, measures women's experiences of screening and also the time between the screen and the results.

Survey forms are supplied to breast screening services and issued annually to women during September. To achieve proportional representation, an average number of women screened per month is calculated using KC62 figures and each screening service is issued with forms for 15% of this monthly figure.

Three-year analysis shows consistency with women attending for the first time feeling more nervous. Consistently around 10% of women continue to question receiving an explanation about the examination. Experiencing pain and discomfort during mammography has increased overtime but remains within the QA Standard. A new national information leaflet was launched in November 2001. Prior to this, local services had used their own leaflet. Women's perceptions and understanding of screening from the national leaflet were similar to their understanding from the local leaflets.

Overall, women continue to be satisfied with their experiences of breast screening. Encouragingly, women are increasingly positive about repeat participation in screening and promoting others to attend, which reflects the high-quality service provided.

51 General practitioner (GP) practices' perceptions of breast screening within the West Midlands

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Breast Cancer Res 2004, **6(Suppl 1)**:P51 (DOI 10.1186/bcr870)

The West Midlands QA Reference Centre, together with the regional breast screening health promotion group, designed a breast screening information sheet for use by health professionals, to ensure that there is a consistent knowledge and appreciation of the National Health Service Breast Screening Programme (NHSBSP) throughout GP practices.

Together with the information sheet, a questionnaire was issued to all GP practices in the West Midlands. The aim was to provide the QA Reference Centre with an insight into the ways in which breast screening is perceived in GP practices. Of the 1019 questionnaires distributed, 387 forms were returned, a response rate of 38%.

Overall, responses were effective in providing a good insight and a better understanding of the way that breast screening is perceived. The results showed most GP practices were excellent in promoting breast screening, and several practices worked collaboratively with Breast Screening Units in order to meet or exceed the standards necessary for the efficient and effective running of the NHSBSP.

It is anticipated that the introduction of the 'Practice Information Pack' will encourage and facilitate the promotion of breast screening and make primary care staff more aware of the significance of health promotion and the importance of encouraging breast screening in GP practices.

52 A pilot's life for us

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Breast Cancer Res 2004, **6(Suppl 1)**:P52 (DOI 10.1186/bcr871)

Following the redevelopment of the National Breast Screening Computer System (NBSS), the Warwickshire, Solihull & Coventry Breast Screening Service agreed to act as a pilot site for the new software. After initially running the existing breast screening software in parallel with the new NBSS software, the system went 'live' on 26 September 2003.

The objectives of piloting the new software were as follows: assessing the database conversion, fault/error finding, identification of cosmetic issues, and assessment of ease of use.

Issues were identified by the screening office staff and logged on the pilot error log, which was submitted to Wealth Management Systems at weekly intervals. Wealth Management Systems discussed the log regularly with the National Project Team and prioritised each entry on the log. A fix for each log was then applied to the software and retested by the screening office staff.

Piloting the new software enabled staff to have an input into the development of the new software, gave them an insight into software development techniques and enabled them to improve working practices, particularly in terms of the 'Right Result' procedure.

From November 2003 the new software was rolled out to the breast screening field.

53 Monitoring radiographic data within the West Midlands National Health Service Breast Screening Programme

J Baker, E O'Sullivan, O Kearins
West Midlands Cancer Intelligence Unit, Birmingham, UK
Breast Cancer Res 2004, **6(Suppl 1)**:P53 (DOI 10.1186/bcr872)

Monitoring Technical Recall/Technical Repeat is important to ensure that the films produced by practitioners working within breast screening are of a consistently high quality. The National Health Service Breast Screening Programme set the standard that at least 97% of mammograms are adequate for radiological interpretation and ≤3% of examinations are repeated for technical reasons.

The West Midlands Breast Screening QA Reference Centre has developed a tool for Technical Recall/Technical Repeat data to be collected quickly and accurately. For the period 1 April 2002–31 March 2003, 2974 (2%) women had a repeat screen. Information is collected on the location of the original screen (mobile or static) and the cause of the repeat. Consistently over time the most common reason for a retake being necessary was inadequate radiographer positioning.

Date	Number of women screened	Number of women recalled/repeated	% of women recalled/repeated
April–June 2002	35,490	907	2.6
July–September 2002	34,527	748	2.2
October–December 2002	35,882	562	1.6
January–March 2003	40,818	757	1.9
April 2002–March 2003	146,717	2974	2.0

It is important to continually monitor radiographic data as changes may reveal equipment problems or indicate training needs, particularly with the introduction of new staff and assistant practitioners to facilitate programme expansion.

54 Maximising the effectiveness of routine quality assurance team visits

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Breast Cancer Res 2004, **6(Suppl 1)**:P54 (DOI 10.1186/bcr873)

Routine quality assurance (QA) is an integral part of the National Health Service Breast Screening Programme. The primary aims of QA are to ensure the maintenance of minimum standards and the continuing improvement of service delivery. To achieve its objectives, QA must look at each service in its totality, while also examining the performance of each aspect of the service. This is attained through routine QA Team visits to each service and also by reviewing performance data for the service as a whole.

The QA Team visits represent a dual approach to QA. The visiting QA Team assesses the service as a whole by carrying out an external review of data, and through internal professional meetings. In order to maximise the effectiveness of this intervention, the service must feel that the process is transparent and must also have input into the way in which the visit process is conducted. In order to obtain this input from services, in 2003 each member of the QA Team individually contacted their peers across the region to seek their views on the purpose and optimum approach for QA Team visits.

The dual focality of QA Team visits will be explored, together with the way in which breast screening professionals perceive the QA Team visit structure and how this perception varies between groups.

55 BreastScreen Australia's experience taking services to rural and remote areas

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Breast Cancer Res 2004, **6(Suppl 1)**:P55 (DOI 10.1186/bcr874)

The BreastScreen Australia Program commenced in 1991. Since then a national network of breast cancer screening services has been established including Screening and Assessment Services, satellite, relocatable and mobile services.

In 2000–2001 the Program screened more than half a million women. The national age-standardised participation rate for women in the target age group 50–69 years was 56.9%. The participation rate varied across States/Territories ranging from 46.3% in Northern Territory to 64.3% in South Australia.

A key objective of the Program is to ensure equitable participation across all sectors of the community. The Program has achieved a relatively high level of equity in screening women across socioeconomic, cultural and geographically rural/remote groups. There was no decline in participation with decreasing socioeconomic status, with only marginal differences for the most and least disadvantaged groups at 55.9% and 55.3%, respectively.

Participation in regional, rural and remote areas is significantly higher than the national participation rate, ranging from 62.1% for regional centres to 57.9% in remote areas.

This presentation will illustrate with pictures and discuss access to breast cancer screening in Australia, specifically the challenges of providing services across vast distances in rural and remote Queensland.

Reference

BreastScreen Australia Monitoring Report 2000–2001. Canberra: Australian Institute of Health and Welfare; 2003.

56 Breast cancer follow-up: a radiographer-led service

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Breast Cancer Res 2004, **6(Suppl 1)**:P56 (DOI 10.1186/bcr875)

Velindre Cancer Centre treats and follows up a range of malignancies. Historically the management of breast cancer has been annual follow-up and, having no formal discharge policy, clinics have become steadily more unmanageable. It was decided to streamline the system by providing a radiographer-led service. National Institute for Clinical Excellence guidelines (Improving Outcomes in Breast Cancer) provide the criteria for patients' admission into this service.

At annual mammography, a comprehensive health questionnaire is used to determine disease status and set protocols exist to allow referral to the breast care team if required.

The senior radiographer leading the service ensures that those patients who are given a normal report receive a letter informing them of the result, as well as arranging their next annual mammogram. The results and any actions taken are annotated electronically onto the hospital information system and supplemented with a weekly forum with the breast team to disseminate information and monitor the system.

This system has run since May 2003 resulting in patients requiring only one hospital visit per year, while allowing more time with the health professionals. The radiographer benefits through role extension and better use of existing skills. The clinics are less fraught, with more time allocated to patients.

57 Ductal carcinoma *in situ* (DCIS): the role of prognostic indicators in informing treatment and reducing local recurrence

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Breast Cancer Res 2004, **6(Suppl 1)**:P57 (DOI 10.1186/bcr876)

Introduction: A retrospective study of cases of DCIS diagnosed in the West Midlands during the period 1 April 1988–31 March 1999 was undertaken. Of the 840 cases diagnosed, full pathology and treatment information was available for 586 cases. Following exclusions a retrospective radiological review was completed on 519 of these cases. Follow-up data were attained for a maximum of 14 years and a minimum of 3 years.

Method: Radiological characteristics were aligned with well-accepted pathological prognostic indicators to provide a preoperative radiological index. Analyses of operation type and local recurrence rates were undertaken.

Results: The correlation between radiological and pathological size was evaluated and it was noted that pathology consistently 'underestimated' the size of the radiologically more extensive tumours. There was good correlation with tumour grade and calcification type, with 53% of high grade tumours displaying casting calcifications.

Conclusions: The dataset indicates that there may be a possible role of preoperative radiological characteristics for providing information previously only available postoperatively to aid management decisions. A greater number of cases would be required to establish this coherently. It is hoped that the Sloane Project will be able to answer these questions.

58 Ductal carcinoma *in situ* (DCIS) down under: patterns of diagnosis and treatment in BreastScreen Victoria

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Breast Cancer Res 2004, **6(Suppl 1)**:P58 (DOI 10.1186/bcr877)

DCIS is a contentious component of breast cancer screening programs. Rates of diagnosis of DCIS within BreastScreen Victoria have risen from 15% of all cancers diagnosed in 1994 to 21% in 2001. Over one-half of the DCIS diagnosed is of a high grade.

BreastScreen Australia initially set as a standard that 10–20% of cancers detected should be DCIS. When revised standards were introduced in 2002, the upper limit for diagnosis was removed.

Most surgical treatment of DCIS is by wide local excision: 73.2% in 2001. However, a greater proportion of women diagnosed with DCIS in rural areas undergo mastectomy (32%) compared with women in urban areas (18%).

Initially around 20% of women diagnosed with DCIS by BreastScreen Victoria underwent axillary dissection. Following the first reporting of nodal status in 1996, research indicated that a majority of these procedures could be classed as inappropriate. This had a dramatic impact on practice, and

since 1998 rates of axillary dissection have remained at around 10% of women diagnosed with DCIS.

While the biology of DCIS is not well understood, it is vital that screening programs are able to explain what we do know about DCIS in order to assist women who are making choices about whether to screen or how to deal with a diagnosis of DCIS.

59 The usefulness of diffuse pattern of distribution in ^{99m}Tc-(V) DMSA scintimammography in the evaluation of *in situ* breast carcinomas

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Breast Cancer Res 2004, **6(Suppl 1)**:P59 (DOI 10.1186/bcr878)

Aim: To evaluate retrospectively the diagnostic accuracy of diffuse (V) DMSA concentration in the detection of *in situ* carcinomas of the breast.

Materials and methods: A total of 71 women with mean age 62.5 years that were referred to us for suspicious breast lesions on physical examination and/or an abnormal mammogram underwent ^{99m}Tc-(V) DMSA scintimammography prior to any surgical intervention. The presence of focal (V) DMSA increased activity, as compared with surrounding tissue, was characterized as a positive study for invasive cancer, and diffuse increased activity was considered as suggesting noninvasive lesions. We evaluated retrospectively this kind of distribution in relation with the histopathology of the specimens obtained surgically. Scintigraphic results were compared with mammograms.

Results: Breast cancer was histologically confirmed in 43/71 patients (invasive cancer in 24 patients and *in situ* cancer [with or without invasive component] in 19 patients). A diffuse (V) DMSA pattern was presented in 30 patients: in 18/19 patients with *in situ* carcinomas (16 ductal *in situ*, two lobular *in situ*), in 2/24 patients with invasive cancer (microcentric ductal carcinoma) and in 10/28 patients with benign lesions associated with epithelial hyperplasia. The sensitivity, specificity, accuracy, positive predictive value and negative predictive value for *in situ* carcinoma were 94.7%, 76.9%, 81.7%, 60% and 97.6%, respectively.

Mammograms depicted suspicious branching or clustered coarse granular type microcalcifications in 10/19 patients with *in situ* cancer. In the remaining 12/30 patients with a diffuse (V) DMSA pattern, only two patients had suspicious microcalcifications (both of them with invasive cancer).

Conclusion: The diffuse pattern of (V) DMSA concentration seems to have an excellent sensitivity in detection of *in situ* breast carcinoma. In combination with a mammogram this could provide useful preoperative information.

60 A review of interval cancers previously assessed in a mammographic screening programme

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Breast Cancer Res 2004, **6(Suppl 1)**:P60 (DOI 10.1186/bcr879)

A retrospective study was undertaken to identify cases where assessment had been performed at the site of the interval cancer. The study was performed for audit purposes and to identify potential learning points to improve assessment techniques. The interval cancers reviewed were from Breast Test Wales (South East) between April 1997 and April 2000.

Four hundred and three intervals were identified. This compares with 735 screen-detected cancers from the same time period (100,211 women screened in total). Eight (2%) had been previously assessed at the site of the interval cancer: five had been assessed for areas of microcalcification, two for asymmetric densities and one for distortion. From the microcalcifications only one had undergone cytological or histological examination.

The mean time between assessment and diagnosis of the cancer was 27 months. It was noted that in several of the cases there had been no change in appearance of the area that developed the interval in several contiguous screens and/or assessments.

We show examples of the cases, including case histories and mammograms.

61 Reclassification of interval cancers and implications for disclosure of audit

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Breast Cancer Res 2004, **6(Suppl 1)**:P61 (DOI 10.1186/bcr880)

Draft guidelines have been circulated on disclosure of interval breast cancer audit, and interval cancer classification will be modified [1].

Blinded review and reclassification of interval cancers to the Southern Derby Breast Screening Programme from 1989 to 2002 was carried out.

Wording of the new classification places fewer cases in 'suspicious features' than were previously in 'false negative'. The results and implications for disclosure of audit are discussed.

	New classification	Old classification
True	245	245
Occult	40	40
Unclassifiable	35	35
Suspicious features/false negative	20	54
Uncertain/minimal signs	130	96
Total	470	470

Reference

1. Royal College of Radiologists Breast Group Working Party: *Guidelines on the Audit of Interval Breast Cancers and the Disclosure of Results*, 3rd draft. London: Royal College of Radiologists; July 2003.

62 The incidence of interval breast cancers from Wirral Breast Screening Unit between 1 January 1994 and 30 June 2000

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Breast Cancer Res 2004, **6(Suppl 1)**:P62 (DOI 10.1186/bcr881)

Objective: To report the detection rate of interval breast cancers in the Wirral Breast Screening Unit between 1 January 1994 and 30 June 2000.

Methods: Women aged 50–64 years were invited for screening, and data prospectively collected for both screen-detected and interval cancer detection rates. Case notes for interval cancers were reviewed together with two-view mammography. True interval and false negative rates were determined for the interval cancers. Rates of recurrence and survival times for these cancers were also collected.

Results: Between 1 January 1994 and 30 June 2000, 82,510 women were invited to attend for screening at the Wirral Breast Screening Unit. A total 63,159 (77%) women attended and 293 screen-detected cancers were observed. A total of 215 invasive interval cancers were detected for the same period, 28% of these occurred in the first 12 month interval, 37% in the next 13–24 months and 36% in the last 25–36 month interval.

Conclusions: The rate of interval cancers was similar over the 3-year period between screening rounds and the incidence of these cancers may not be reduced by shortening the mammographic screening period.

63 Mammographic tumour features can reliably predict the long-term outcome of women with 1–14 mm invasive breast cancer: suggestions for revision of current therapeutic practice and the TNM classification system

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Breast Cancer Res 2004, **6(Suppl 1)**:P63 (DOI 10.1186/bcr882)

We studied the 24-year survival of 714 women with 1–14 mm invasive breast cancer according to mammographic features, including appearance of calcifications and masses. The most common mammographic feature was a stellate lesion with no associated calcifications (420 cases, 59%). Patients with stellate lesions had excellent long-term survival (95%). Casting-type calcifications were observed in 52 (7%) cases and were significantly associated with a positive lymph node status, poorer histological grade, and increased risk of breast cancer death (hazard ratio = 9.19, 95% confidence interval = 4.18–20.17). Except for tumours with casting type calcifications, all tumours less than 10 mm had excellent survival, regardless of node status, histological grade or treatment. For those with casting-type calcifications, survival was poorer even with 1–9 mm tumours (72% at 20 years). For 10–14 mm tumours, 20-year survival was 52% for those with

casting calcifications, and 86–100% otherwise. Small invasive cancers accompanied by casting-type calcifications have unexpectedly poor prognosis for their size. Neoductgenesis offers a possible explanation for the unexpectedly poor outcome. There is a need to develop treatment protocols for this group. After exclusion of tumours with casting-type calcifications, the remainder have extremely good prognosis when treated with surgery and no adjuvant therapy.

64 Screening-mammography-detected lesions undergoing benign surgical excision: review of mammography features and preoperative needle biopsy results

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Breast Cancer Res 2004, **6(Suppl 1)**:P64 (DOI 10.1186/bcr883)

Introduction: The aim of assessment of screen-detected lesions is to achieve a definitive diagnosis and thereby avoid diagnostic surgery.

Aim: To analyse the needle biopsy results and mammography features of cases undergoing surgical excision for benign screen-detected lesions.

Methods: A total of 155,621 women were screened by SouthEast London Breast screening programme from April 1998 to March 2003; 8836 (5.7%) were assessed. The study group consisted of 182 lesions that were benign on final surgical histology (0.1% of women screened). Needle biopsy results and mammography features were recorded on a database.

Results: Final surgical histology of the lesion: fibrocystic change (26%), radial scar (24%), fibroadenoma (14%), papilloma (11%) and atypical ductal hyperplasia (7%) and miscellaneous other (15%). The mammography features of benign lesions excised were: well-defined mass (38%), microcalcifications (28%), stellate distortion (28%), asymmetry density (3%), and 4% other signs.

All 182 cases underwent biopsy, either ultrasound 14 G core biopsy or stereo 14 G core biopsy or 11 G vacuum biopsy. Core needle biopsy results: 13% (24/182) had inadequate, 27% (50/182) benign, 42% (76/182) suspicious, 18% (32/182) no biopsy performed; 21% (39/182) underwent cytology. Out of the 39 cytology aspirates performed: 41% (16/39) suspicious, 28% (11/39) benign, 31% (12/39) inadequate.

Discussion: The most common benign lesions requiring surgical excision are mass and microcalcifications due to fibrocystic change and distortion due to radial scar. Forty-two per cent (76/182) of core biopsy results showed atypia/suspicious findings. More accurate nonoperative diagnosis obtained by excising large volume biopsy techniques such as vacuum biopsy should decrease the need for surgical excision in these cases.

65 Audit of stereotactic core biopsies for microcalcification

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Breast Cancer Res 2004, **6(Suppl 1)**:P65 (DOI 10.1186/bcr884)

Introduction: Microcalcifications are seen in benign and malignant lesions. Stereotactic biopsy along with digital equipment has made targeting these more accurate. This is a retrospective audit of 147 core biopsies done at the Colchester–Chelmsford screening unit.

Method: All patients who had core biopsies for assessment of microcalcifications are included in this study and were discussed in the multidisciplinary team meeting.

Results: Seventy patients had benign microcalcifications seen both on X-ray and pathology. Fifty-two patients had malignant calcifications associated with ductal carcinoma *in situ* (DCIS).

Table 1

Microcalcification seen		Final diagnosis postsurgery	
X-ray	Pathology	Benign (number of patients)	DCIS (number of patients)
Seen in 10 patients	None	7	3
Six patients not seen		2	4 (2 had B4 on core)
One patient microcalcification seen benign but R5 microcalcification			DCIS

Of the remaining 25 patients, five had a repeat core, which showed benign calcification, and three were discussed at the multidisciplinary team meeting (calcification seen on X-ray and not on pathology) and discharged to recall in 1 year's time. Table 1 shows the results of the other 17 patients.

Discussion: This audit shows that 11.9% of patients had a diagnostic operation, as the core biopsy could not give a definitive diagnosis. The question whether this can be improved by repeat core or mammotome cores remains to be answered.

66 Lobular neoplasia diagnosed on stereotactic core biopsy: a management conundrum?

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Breast Cancer Res 2004, **6(Suppl 1)**:P66 (DOI 10.1186/bcr885)

Background: When breast core biopsy reveals lobular neoplasia (lobular carcinoma *in situ* [LCIS] or atypical lobular hyperplasia [ALH]) a management dilemma follows, as uncertainty regarding the significance of LCIS/ALH exists. Is this an indicator of increased risk of breast cancer or should it be considered a marker for more serious local pathology? Should surgical excision be undertaken in these cases?

Purpose: To correlate the finding of lobular neoplasia on stereotactic core biopsy with final histology and thus determine the appropriate management of such cases.

Method: The radiological and histological features of the cases of LCIS/ALH on stereotactic core biopsies since 1994 were reviewed and correlated with final histology.

Results: Ten cases of ALH and 12 cases of LCIS were found from a total of 2498 (0.01%) stereotactic core biopsies. Mammographic signs were distortion in two (9%), asymmetry in one (4%) and microcalcification in 19 (87%). Note was made of whether the microcalcification was in the area of LCIS/ALH, in benign tissue alone or in both. The LCIS was also classified histologically: classical, pleomorphic and solid ductal carcinoma *in situ* (DCIS) like.

Surgical histology was available in 20 cases with one case of invasive ductal carcinoma (5%), three invasive lobular carcinoma (15%), three DCIS alone (15%), and one of both invasive lobular carcinoma and DCIS (5%). The diagnosis was upgraded (from LCIS/ALH) in eight cases (40%)

Conclusion: We recommend surgical excision should be carried out when lobular neoplasia is diagnosed on the core biopsy. The benign breast biopsy rate should not be significantly affected, as these lesions are rare.

67 The relevance of clinical audit results to commissioning services

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Breast Cancer Res 2004, **6(Suppl 1)**:P67 (DOI 10.1186/bcr886)

The Association of Breast Surgery at the British Association of Surgical Oncology audit of screen-detected breast cancers is a clinical audit that monitors diagnosis and treatment outcome data for screen-detected breast cancer against National Health Service (NHS) Breast Screening Programme standards. The audit is used to identify achievement of and failure to meet the standards by screening services and to direct appropriate recommendations and actions.

This valuable data resource is unfamiliar to many NHS organisations responsible for commissioning breast cancer services such as Primary Care Trusts, Strategic Health Authorities and Cancer Networks. To make the audit more accessible to these organisations a *Key Outcomes* booklet was produced for each West Midlands screening service, which aimed to present the findings that are most relevant to commissioners. Results were related to relevant government targets in the NHS Cancer Plan (2000) and the National Institute for Clinical Excellence publication *Improving Outcomes in Breast Cancer* (2002).

Production of the *Key Outcomes* booklet enabled the Association of Breast Surgery at the British Association of Surgical Oncology audit results to reach a wider, more generalised audience, while the focus on individual screening services allowed a more in-depth analysis of the audit results tailored to areas of particular interest.

68 West Midlands screening histories project: methodology and use as an audit tool

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Breast Cancer Res 2004, **6(Suppl 1)**:P68 (DOI 10.1186/bcr887)

The Screening Histories Project aims to assign a screening status classification to all primary breast cancers in women aged 50–64, who were diagnosed in the West Midlands from 1 March 1988 to 31 March 2001. The possible classifications

are: screen detected, interval cancer, nonattender, lapsed attender and diagnosed before invite.

To obtain a screening status, screen-detected cancers are downloaded from the National Breast Screening Computer System (NBSS), matched against the West Midlands Cancer Intelligence Unit's cancer registration database, and classified as screen detected. All other eligible cases from the cancer registration database are manually checked against the NBSS. This involves assigning each case a screening unit and printing individual classification forms. The screening status is dependent upon whether the woman was invited prior to diagnosis and whether she attended her invitations.

The first project phase is complete and all women diagnosed up to 31 March 1998 have been assigned a screening history. Thirty-seven per cent of women had a screen-detected cancer, 22% were interval cancers, 14% were diagnosed before invite, 11% were nonattenders and 2% were lapsed attenders.

The dataset obtained by applying this algorithm is a valuable resource for the evaluation of breast screening in the West Midlands.

69 The value of arbitration in a breast screening programme

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Breast Cancer Res 2004, **6(Suppl 1)**:P69 (DOI 10.1186/bcr888)

Double reading with arbitration is identified as the best pattern to detect the maximum number of cancers. The balance between cancer detection and recall rates must be maintained while acknowledging the steep learning curve for new film readers in the National Health Service Breast Screening Programme. A recent study highlighted these findings [1].

We present the data on 761 arbitrated cases that support this study. Eighty per cent of first-read recalls and 57% of second-read recalls were overruled. Following review, 96% of arbitrated cases were returned to routine screen. Of the remaining 4% ($n = 27$), 10 were cancers and two were radial scars.

No particular pattern was identified among readers for hits or misses. Arbitration provides a group of cases where interpretation is difficult. Analysis of first reader over recall should increase specificity. Reviewing arbitrated cancers is a valuable learning exercise. Identifying specific weaknesses, strengths and arbitrator recall rates allows us to maximise the benefits of different working practices.

Can the National Health Service Breast Screening Programme afford not to double read screening mammograms?

Reference

1. Liston JC, Dall BJG: *Clin Radiol* 2003, **58:**474-477.

70 Assessment clinics at 'Avon Breast Screening Unit': what has changed in 5 years?

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Breast Cancer Res 2004, **6(Suppl 1)**:P70 (DOI 10.1186/bcr889)

Introduction: There have been many changes in the breast screening programme over the past few years. The most significant locally is probably the introduction of two-view mammography at all rounds since April 2003. We also introduced a formal weekly arbitration meeting in December 2001 where borderline patients are discussed and a collective decision taken regarding the need for assessment. All those who read screening films attend this meeting.

We perceived there had been a change in outcomes, procedures performed in the clinic, and overall pick-up rate. This could be an indicator of change at a national level. Hence, this study to compare the assessment clinics was undertaken.

Aims and objectives: To compare the assessment clinics conducted in 1998 with those of 2003.

Materials and methods: Retrospective analysis of films and notes of all patients assessed during September and October 1998 and 2003.

Results:

	1998	2003
Number of patients assessed	192	188
Assessed within 3/52 weeks of screening	87%	41%
Surgical referral	30 (15.5%)	53 (28%)
Procedures in clinic	38 (20%)	53 (28%)
Final malignant diagnosis	20 (10%)	40 (21%)

Conclusion: More patients were assessed sooner in 1998. However, more complex procedures and more procedures overall were performed in 2003. The cancer pick-up rate doubled in 2003.

71 Maintaining standards through coordinated follow-up of Quality Assurance (QA) Team visit recommendations

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Breast Cancer Res 2004, **6(Suppl 1)**:P71 (DOI 10.1186/bcr890)

The Commission for Health Improvement report into the West London Breast Screening Service recommended that a formal structure for the follow-up of recommendations made at QA Team visits is implemented.

In the West Midlands, breast screening services are visited every 3 years as part of a rolling programme. Following a QA Team visit, a service can expect 3-month and longer term recommendations, and on rare occasions immediate recommendations concerning areas that require improvement. Written conformation of immediate and 3-month recommendation is issued to the service within 1 week of the visit. Longer term recommendations are included in the written QA Team visit report, which is issued within 4 weeks of the QA Team visit. A detailed process has been put in place that tracks the receipt of recommendations within the required timescales, highlights nonresponses and distributes the recommendations to the relevant QA Team members for classification and further instruction.

One-year post visit, all recommendations must be completed to the satisfaction of the visiting QA Team. At this point a formal document is compiled that details the recommendations and responses from the breast screening service. This document is then sent to the host trust chief executive, director of breast screening and lead primary care trust coordinator to sign, indicating that the resulting actions have been incorporated fully into the service's policies and procedures. In the event of noncompliance, separate reporting mechanisms have been introduced.

72 Prospective estimation of rates of change in mammographic parenchymal patterns: influence of age and of hormone replacement (HRT) therapy

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Breast Cancer Res 2004, **6(Suppl 1)**:P72 (DOI 10.1186/bcr891)

The objective of the study described in this presentation was to assess the effect of age, breast size and use of HRT on the rate of change of mammographic parenchymal patterns, and the effect of age on the probability of misclassification between patterns. It was designed as a longitudinal study of the members of the treatment arm of a nonrandomized screening trial. A model was fitted to the data comprising the observed Wolfe patterns on each woman, with age and breast size as predictors of breast density at first screen, age and HRT use as predictors of change in density at future screens, and age as a predictor of misclassification of true density between favourable (nondense) and unfavourable (dense) patterns (according to the Wolfe classification). The probability of being in a nondense, favourable state increases with age, as does the rate of change from dense to nondense patterns. These results are consistent with previous work. The probability of nondense patterns and the rate of change to nondense patterns are reduced with HRT use. Errors of classification are relatively rare, but are dependent on the age of the subject.

73 The effect of age and breast density on the sensitivity of mammography

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Breast Cancer Res 2004, **6(Suppl 1)**:P73 (DOI 10.1186/bcr892)

This study examines the extent to which differences in sensitivity by age can be attributed to variations in breast density using a reliable, computer-assisted, continuous measure of per cent breast density.

We included women aged 40–79 years, not using hormone replacement therapy, who attended BreastScreen Victoria for first-round screening mammography in 1994 and 1995 (1002 breast cancers) and for subsequent-round screening (381 breast cancers) in 1995 and 1996. True positive cancers were invasive breast cancers diagnosed at screening and false negative cancers were cancers diagnosed within 24 months of a negative screening examination.

The effect of age (years) on the risk of having a false negative cancer (first round: odds ratio [OR] = 0.94, 95% confidence interval [CI] = 0.92–0.96; and second round: OR = 0.93, 95% CI = 0.90–0.96) was modestly attenuated when adjustment was made for mammographic density (first round: OR = 0.96, 95% CI = 0.94–0.98; and second round: OR = 0.94, 95% CI

= 0.91–0.98). Adjusting for family history, symptom status, and tumour characteristics (grade, size and morphology) did not influence the estimates of the effects of age.

The study confirms that younger women have lower sensitivity but demonstrates that the lower sensitivity cannot be completely explained by variations in breast density.

74 Can the sensitivity/specificity of reporting indeterminate breast calcifications be improved?

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Breast Cancer Res 2004, **6(Suppl 1)**:P74 (DOI 10.1186/bcr893)

Aim: To assess whether the sensitivity and specificity of the current grading system for screen-detected mammographic indeterminate microcalcification can be improved.

Materials and methods: One hundred and twenty-seven screen-detected indeterminate (R3) microcalcifications were retrospectively and independently assessed by six experienced screening radiologists. Information was gathered in relation to specific features of the calcification and their level of suspicion graded 1–4. An informed decision was requested as to outcome. These outcomes were then related to final histological diagnosis.

Results: Of the 127 cases, 32 were histologically malignant and 95 benign. In only 19 cases of R3 microcalcification did all radiologists agree. There was significant interobserver variation. Reader sensitivity was 53% (median, range 31–69%) and specificity was 72% (median, range 57–88%). Cut-off points for features graded 3 or greater gave a change in sensitivity to 64% (median, range 34–88%) and specificity 55% (median, range 34–82%).

Conclusion: Radiological interpretation of indeterminate microcalcification lesions is difficult. Significant variation was identified between individual radiologists. Attention to specific features allows some increase in sensitivity but not enough to obviate biopsy.

75 The value of three-dimensional (3D) ultrasound examination in the assessment of small breast tumours

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Breast Cancer Res 2004, **6(Suppl 1)**:P75 (DOI 10.1186/bcr894)

Aim: The purpose of this study was to determine the value of 3D ultrasound examination in the diagnostic procedure of the small breast tumours.

Materials and methods: A total 182 small breast tumours were analysed in 146 patients aged ranging from 17 to 72 years. All patients had undergone two-dimensional (2D) ultrasound examination, 3D ultrasound examination and ultrasound-guided fine needle aspiration biopsy. 2D ultrasound examination was performed with seven to 12 linear probes. 3D ultrasound examination was performed with a linear scanner, 6–12 MHz (Voluson 730; KretzTechnik, Zipf, Austria). Fine needle aspiration biopsy was performed under ultrasound biopsy, method free hand.

Results: The study group consisted of 182 small breast tumours. The 2D ultrasound examination demonstrated dense cysts (9.34%), fibroadenomas (36.81%), and probable carcinomas (53.85%). 3D ultrasound examination showed dense cysts (48.9%), fibroadenomas (34.07%), and probable carcinomas (17.03%). The cytological results were benign (88.46%) and malignant (11.54%).

Conclusion: 3D ultrasound examination improves small breast tumour diagnostics.

76 Design of a retrospective study of computer-aided detection in mammographic screening: Computer Aided Detection Evaluation Trial

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Breast Cancer Res 2004, **6(Suppl 1)**:P76 (DOI 10.1186/bcr895)

The National Health Service Breast Screening Programme is an intensive consumer of radiology time. In principle, screening mammograms must be double read, and this puts considerable strain on human resources. The possibility of using single reading assisted by computer-aided detection rather than double reading is therefore an important research issue. Before expending considerable resources on a prospective randomised trial, we design a retrospective study involving re-reading of previously

double-read mammograms (Computer Aided Detection Evaluation Trial). This was an equivalence, powered to assess whether the sensitivity of a single human reader with the R2 system of computer-aided detection was at least no worse than 10% less sensitive than the previous two human readers. Various complications had to be taken account of in the design:

- power calculations suggested we needed 15,000 mammograms to give the required number of cancers, but funding was only available to re-read 10,000;
- the ethical problem of potential *de novo* discovery of previously missed cancer;
- a limited period of free availability of the R2 system; and
- a need to avoid previous readers re-reading the same mammograms.

Design strategies to cope with these are described in this poster.

77 Quality assurance of routinely collected data in the Computer Aided Detection Evaluation Trial

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Breast Cancer Res 2004, **6(Suppl 1)**:P77 (DOI 10.1186/bcr896)

A study may only be feasible when routinely collected data (RCD) are used to identify participants. RCD from one centre in a retrospective study of computer-aided detection (CAD) in breast screening are considered. Double-read mammograms were re-read by a different reader using CAD (R2 ImageChecker®) and the cancer detection and recall rates were compared.

Subjects attended routine screening during 1996 and were aged 50 years or over. Among RCD subjects, 11,947 (92.5%) were eligible. From the study sample ($n = 5037$), a subsample of 650 (13%) subjects was examined.

Previous attendance was incorrect in all four subjects with earlier screening at a different centre. The reader was correctly recorded in all but one subject where it was missing on the paper copy. Whether a subject was recalled for further examination was correct for all subjects; however, single-reader recall, when recall was requested by only one radiologist, was incorrect in 22 (3%) cases; each was among the 53 (8%) recalls showing 42% were incorrect (95% confidence interval, 28–56%).

Single-reader recall was unreliable and previous attendance did not have sufficient detail to report the whether a screen was prevalent. Both were checked throughout the study. Issues raised when using RCD are discussed.

Late Addition

41 Compression/encryption technology applied to Dicom/digitised mammography

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Figure accompanying abstract 41
(see page S17 for text)