Abstracts from Symposium Mammographicum 2002 University of York, 17–19 July 2002

1 Molecular pathology of breast cancer

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The multistep model of carcinogenesis in the breast suggests a transition from normal epithelium to invasive carcinoma via non-atypical and atypical hyperplasia and *in situ* carcinoma. The introduction of mammographic screening has led to the increased detection of preinvasive disease, and this has highlighted deficiencies in the biology and classification of such lesions. The excitement surrounding the development of DNA microarray analysis and proteomics has raised expectations about the role of these techniques in understanding the biology and translating these data to clinical practice. Only a few years ago, scientists studied disease initiation and progression in a linear fashion, identifying and examining one cancer-related molecule at a time. The recent development of technologies that allow a large number of genes and gene products to be analysed simultaneously has brought renewed interest to breast cancer research, with the hope of identifying a unique 'fingerprint' for each tumour and hence individualised treatment. To date, histopathological assessment has been at the heart of clinical management – does the new technology herald the end?

2 Hormone replacement therapy (HRT): indications and side effects

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Late submission, see page S22

3 Breast cancer and hormone replacement therapy (HRT): collaborative reanalysis of data from 51 epidemiological studies of 52,705 women with breast cancer and 108,411 women without breast cancer

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The Collaborative Group on Hormonal Factors in Breast Cancer has brought together and reanalysed about 90% of the worldwide epidemiological evidence on the relation between risk of breast cancer and use of hormone replacement therapy (HRT). Data on 52,705 women with breast cancer and 108,411 women without breast cancer from 51 studies in 21 countries were collected, checked and analysed centrally. Among current users of HRT or those who ceased use 1–4 years previously, the relative risk of having breast cancer diagnosed increased by a factor of 1.023 (95% confidence interval [CI] 1.011–1.036; $2P = 0.002$) for each year of use; the relative risk was 1.35 (95% CI 1.21–1.49; $2P = 0.00001$) for women who had used HRT for 5 years or longer (average duration of use in this group 11 years). Five or more years after cessation of HRT use, there was no significant excess of breast cancer overall or in relation to duration of use. There was no marked variation in the results according to hormonal type or dose but little information was available about long durations of use of any specific preparation. Cancers diagnosed in women who had ever used HRT tended to be less advanced clinically than those diagnosed in never-users. In North America and Europe the cumulative incidence of breast cancer between the ages of 50 and 70 in never-users of HRT is about 45 per 1,000 women. The cumulative excess numbers of breast cancers diagnosed between these ages per 1,000 women who began use of HRT at age 50 and used it for 5, 10 and 15 years respectively, are estimated to be 2 (95% CI 1–3), 6 (95% CI 3–9) and 12 (95% CI 5–20). Whether HRT affects mortality from breast cancer is not known.

4 Hormone replacement therapy (HRT) and its effect on mammographic specificity and sensitivity

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It is now widely recognised that the use of hormone replacement therapy (HRT) can influence mammographic pattern. Approximately 17–24% of women using HRT may have demonstrable changes on sequential mammography consisting either of a generalised increase in background density or focal changes such as cyst formation or an increase in the size of fibroadenomata. In addition to demonstrable change, HRT may also lead to maintenance of breast density, so that the natural

involution usually seen with age is not visualised. As the number of women taking HRT increases, and these women are in the age group targeted by breast screening programmes, there has been an increasing interest in the influence of HRT on the sensitivity and specificity of mammography.

Over the past few years several studies have been published addressing this issue and the results of these will be reviewed within the lecture. Overall, there is evidence of a reduction in sensitivity with HRT use, although this may be confined to women with a dense background pattern only. In addition, there is also evidence of decreased specificity in women taking HRT.

5 Technology update

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Full field digital mammography has continued to develop. There is now a remarkable variety of different designs. One of the oldest (photo-stimulable phosphors) has received a new lease of life with the introduction of dual reading technology at a 50 μm resolution. Systems using a selenium detector plate with a 70 μm resolution are being introduced this year. Such systems have the advantage of converting X-ray energy directly to an electrical signal. A low dose system, which uses a scanning technique with a linear array of silicon detectors, has also been developed. Dual displays with 2000 × 2500 resolution are becoming standard. While such systems may be readily introduced into a symptomatic role, their use in screening remains problematic. All the digital systems can overcome the latitude limitations of the traditional film screen mammography, and appear to offer advantages in terms of image quality, particularly with better contrast resolution. The overall contrast can also be optimised for each image. The main limitations to the wider use of this technology remain the high start-up costs and the lack of proven clinical advantages.

6 Computer aided detection

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Computer analysis of digitised mammograms is now remarkably sensitive for the detection of calcifications and masses. This sensitivity, however, is only achieved at low levels of specificity. System developers have tried to get around this difficulty by developing prompting systems, in which the computer algorithms are used to alert film readers to possible areas of abnormality. The idea is that the computer may be able to improve a radiologist's, or radiographer's, sensitivity while relying on his or her professional judgement to maintain acceptable levels of specificity.

Research in the United States has shown that the algorithms are sensitive and that prompting systems do not adversely affect specificity. The evidence that they can improve radiologists' sensitivity is less certain, although there are now studies showing that improvements have been achieved. The key unanswered question is what is the potential impact of these tools on the decision-making of radiologists and radiographers working in the UK screening programme? A large scale evaluation, involving 50 film-readers, is underway to assess this impact. Interim results will be presented at Symposium Mammographicum. Issues include the significance of abnormalities other than masses and calcifications, and the relative importance of errors of detection and errors of decision-making.

7 Review of clinical trials

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Clinical trials of full-field digital mammography to date have compared sensitivity, specificity, and receiver operating characteristic (ROC) curves of digital to screen-film mammography, typically in paired studies of the two modalities. The largest study to date has been conducted in women at two institutions in the USA involving 6,736 paired examinations of women aged 40 and over presenting for screening mammography at the University of Colorado and University of Massachusetts Medical Centers. Of 1,467 subjects recommended for additional evaluation on at least one modality, 181 biopsies were performed, yielding detection of 42 cancers. Nine cancers were detected only by digital mammography, 15 only by screen-film mammography, 18 by both, and 8 by neither modality. The difference in cancer detection was not statistically significant ($P > 0.1$). Digital mammography resulted in fewer recalls than screen-film (799 *versus* 1,007; $P < 0.001$). ROC curve areas were 0.74 for digital and 0.80 for screen-film ($P > 0.1$). Results of other trials conducted to date, primarily diagnostic studies for regulatory approval, will also be described, along with the design of the National Cancer Institute sponsored American College of Radiology Imaging Network (ACRIN) DMIST study of 49,500 women, which is currently underway.

8 Reconstruction

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The widespread popularity of breast-conserving surgery coupled with frequency of cosmetic failure has led to the development of new oncoplastic techniques, which can avoid a poor cosmetic outcome. These techniques provide a 'third option' to wide excision or mastectomy in three different ways. Firstly, they extend a very wide excision of breast tissue without risk of major deformity. Secondly, they extend the scope of conservation to patients with larger tumours, avoiding mastectomy without compromising adequate resection. Thirdly, they can be used to avoid mastectomy in patients with local recurrence and correct unacceptable deformities following previous breast-conserving surgery.

When mastectomy is unavoidable, a skin-sparing approach minimises scarring and optimises the cosmetic result without compromising oncological principles or disease control. The breast can be resected and reconstructed through a small central aperture, using the native skin envelope to mimic a breast of life-like shape, size and ptosis. In future, new approaches to preoperative assessment are likely to identify patients who will benefit most from these new oncoplastic procedures. The UK has launched a unique programme for training in all aspects of diagnosis, resection, reconstruction and clinical management. This exciting new development heralds the birth of the oncoplastic breast surgeon.

9 Imaging implants

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Implants are used for breast augmentation and for reconstruction following surgery. Magnetic resonance imaging (MRI) is the modality of choice for evaluating such breasts with a higher sensitivity and specificity than mammography or ultrasound for detecting implant rupture and an ability to assess adjacent tissues.

Evaluation is tailored to the clinical setting. Sequences are chosen to differentiate fat, fluid and silicone. Where there is suspicion of malignancy, dynamic contrast enhanced sequences are included.

Indications for imaging include suspected rupture, fluid collections, implant migration or a palpable mass. Implant rupture may be intracapsular or extracapsular. MRI is the most reliable modality for identifying and characterising rupture (sensitivity 95%, specificity 93%). The 'linguine' sign due to the collapsed implant shell has the highest sensitivity. Where there is extracapsular silicone, MRI can document the extent of migration. Examples of normal and abnormal implants will be demonstrated.

There is no evidence that implants result in an increased risk of breast cancer nor of any adverse effect on stage at presentation. Similarly there is no evidence that breast reconstruction delays diagnosis of local recurrence. Contrast enhanced MRI may be the most accurate method for detecting recurrence but there have been no studies to evaluate routine MRI surveillance.

10 When do women really want to attend screening?

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By 2004 the National Health Service Breast Screening Programme (NHSBSP) is expected to deliver 40% more work by expanding to the age of 70 and two views. Additionally the NHS Plan charges the NHS with delivering improved access to all services but most particularly Primary Care. We aimed to investigate women's preferences regarding day and time of both screening and contacting the screening office. A self completed postal questionnaire was sent to a random 50% sample of women attending for breast screening between April and June 2001. Eight hundred and thirteen of the 1,396 questionnaires were returned, giving a response rate of 58%. Of these returns approximately half expressed a preference in day to be screened, but Saturday was the least popular option. Of the under 64s, 54% would prefer to be screened before 10 a.m. and after 4 p.m., compared with only 12% of women over 64 years. Seventy-eight per cent of women wanted to contact the screening office by phone and 49% between 8 a.m. and 12 noon. Extending hours of access sounds politically attractive and improves utilisation of expensive capital equipment. There is little enthusiasm among women attending screening, particularly in the over 64s. However, for a small but significant number of younger women access outside their working hours is preferable.

11 A customer satisfaction measuring instrument for women using the breast screening service: preliminary development and testing

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Women who attend for breast screening are in general not motivated by ill health. The benefit of any such programme depends upon repeated use and satisfied clients are more likely to continue the relationship with their health care provider. However, evaluation of satisfaction with the service is impeded by the lack of a specific tool for use within this target population. The purpose of the present study was to develop and conduct preliminary testing of the properties of a customer satisfaction measuring instrument (CSMI) that reflected aspects of importance to the users and providers of the breast screening service, hence ensuring content validity of the tool. Development and testing involved four studies and resulted in a 23 item CSMI, which comprised six dimensions addressing location, arrival at the unit, the mammogram, the breast screening service, the staff and information.

12 Mammography and women over 65

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Aim: Self-referral mammography is available for all women over the age of 65. In our unit 80% of women in the 50–64 year age group and 15% in the over 65 age group attend for screening. The aim of the study was to assess why only a small percentage of women referred themselves for screening.

Method: This was mainly a postal questionnaire study (symptomatic patients were given the questionnaires by the clinician).

Results: One hundred and seventy-five questionnaires were sent and 101 (57.7%) were returned. The main reason for self-referral was reminder by radiographers (43%) and the credit card reminder (26%) which is used in our unit. Of non-attendees, 68% thought it was not important to attend after the age of 65.

Discussion: In this small study we have shown that older women are still not aware of their risks with regard to breast cancer. Women believe that because screening stops at 64 their risk of getting breast cancer also stops. This study shows that radiographers have a strong influence on women attending screening.

Conclusion: Women over 65 need more education about breast cancer both with regard to their risks and why regular screening is valuable. The extension of screening age may address some of these issues.

13 A review of screen detected breast cancers among aboriginal women in Western Australia

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The cancer mortality of Australian indigenous people is higher than non-indigenous people, but at the same time the reported incidence of cancer is broadly similar for both groups. The objective of the study was to determine whether the screening cancer detection rate is similar for indigenous and nonindigenous women.

Method: BreastScreen Western Australia (BSWA) is a free mammographic screening service targeting women 50–69 years of age. BSWA records from January 1990 to December 2000 were reviewed. Women are routinely asked to indicate whether they are of aboriginal or Torres Strait Islander origin (ATSI).

Results: A total of 450,425 women were screened by BSWA from January 1990 to December 2000. 2,314 cancers were detected with a total cancer detection rate of 5.1 cancers per 1,000 women screened. 4,916 women of ATSI origin were screened during this interval. 31 breast cancers were diagnosed, with a total cancer detection rate of 6.3 cancers per 1,000 women screened.

Discussion: Cultural, geographic and economic barriers exist that limit indigenous women's access to and the acceptability of many western health initiatives, including screening mammography. BSWA has a special obligation to make information on and access to services as culturally acceptable as possible to this group of clients.

14 The accuracy of imprint cytology of breast core biopsy under ultrasound guidance

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Introduction: Histological analysis of core biopsy of breast lesions takes a minimum of 24 h, but imprint cytology of a core biopsy can be reported within an hour. This study validates the accuracy of imprint cytology from core biopsy of breast lesions obtained under ultrasound control.

Method: One hundred and fifty consecutive core biopsies from breast lesions of 142 patients were performed. The cores were placed on six microscopy slides to obtain imprint cytology. Imprint cytology and routine histology of the cores were assessed independently by two pathologists.

Results: See Table.

	Imprints	Cores
Inadequate	6	7
Benign	80	79
Atypical	5	2
Suspicious	2	0
Malignant	57	62

None of the imprints reported as malignant subsequently proved to be benign and only one of the imprints reported as benign subsequently proved to be malignant.

Conclusion: Imprint cytology of core biopsies correlates well with subsequent histological results and could be used to provide a rapid preliminary diagnosis. This rapidly available technique could reduce anxiety in patients with benign lesions and help treatment planning in patients with breast cancer.

15 UK National Health Service Breast Screening Programme (NHSBSP) multicentre image guided biopsy trial: an update

The UK Mammotome Trial Group (W Teh, MJ Michell, ARM Wilson and P Britton) presented by B Shah
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This is an update on randomised control trials (RCTs) evaluating the efficacy of 11-gauge mammotome (Ma) to 14-gauge core biopsy (CB). A total of 614 women with impalpable clustered microcalcifications and/or distortions were prospectively recruited in a multicentre (Edgware, King's, Nottingham and Cambridge) RCT. Specimen radiographs were obtained for all biopsies performed for microcalcifications. Complete data for 585 women were analysed. Two hundred and ninety-three CB and 292 Ma had been performed on 554 microcalcifications, two distortions with microcalcifications and 29 distortions. There are 191 cancers (32%) consisting of 54 invasive and 137 *in situ* carcinoma. Comparing CB and Ma, the absolute sensitivity for ductal carcinoma *in situ* (DCIS) was 79.2% and 80%, respectively, with a complete sensitivity of 89.6% and 96.6%, respectively ($P = 0.1$). The absolute sensitivity for invasive disease is 33.3% and 58.3%, respectively ($P = 0.06$). Mammotomy is significantly less likely to under-stage malignant disease when a B3 result is obtained compared to CB (17.5% *versus* 64%, respectively). The analysis suggests that the greatest benefit of mammotomy is in clustered microcalcification with an indeterminate appearance and in minimising the under-diagnosis of associated malignant disease.

16 Diagnosis of lymph node metastases by axillary node core biopsy in patients presenting with primary operable breast cancer

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Preoperative diagnosis of axillary nodal metastases allows selective axillary clearance in patients with confirmed nodal metastases. This study examines the utility of ultrasound guided core biopsy of abnormal axillary nodes in patients presenting with operable breast cancer.

All patients presenting with suspected operable breast cancer had their axilla scanned. Nodes were classified as abnormal if the AP/width ratio was less than 2 or a focally thickened cortex was seen. Abnormal nodes underwent ultrasound guided core biopsy except a few where fine-needle aspiration (FNA) was performed due to the proximity of axillary vessels.

In 50 women nodes were seen in 30, of which 17 were abnormal. Thirteen cores and four FNAs were performed. Nine (69%) of 13 cores were malignant and one of four FNAs were malignant. Correlation with surgical histology will be performed.

Ultrasound can identify abnormal nodes in women with breast cancer. Most of these nodes are malignant and this can be confirmed with ultrasound guided core biopsy.

17 Plastic surgery for patients with postmastectomy syndrome

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Objective: Improvement in the quality of life of patients given definitive treatment for breast cancer.

Materials and method: The Institute has acquired a wide and long-term experience in combination and multimodality treatment of breast cancer patients. One of the complications of such treatment is postmastectomy lymphoedema. This occurs, according to different researchers, in 33.3–84.3% of the cases. We have developed techniques of multimodal treatment for postmastectomy lymphoedema including oral administration of Cyclo-3 Fort, pneumatic compression, myostimulation by magnetic induction and lymph-drain surgical interventions employing omentobrachyopexy. Forty-six patients received such treatment.

Results: With microsurgical autotransplantation of the greater omentum, oedema reduction made up 79.0 ± 2.28%, with its transposition – 81.2 ± 3.18%. In two patients, the profile of the missing breast was restored after correction of lymphovenous insufficiency; in one patient, excision of radiation ulcer in the anterior thoracic wall was performed with plastic building of the defect.

Conclusion: The above method of multimodality treatment for postmastectomy oedemas using plastic surgery is beneficial for the rehabilitation of breast cancer patients, considerably improving the quality of their life.

18 The mammographic appearances of benign mammary mucocele-like lesions

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Mucocele-like lesions of the breast were first described in the pathology literature in 1986. No series of the mammographic appearances of these lesions has been described. These benign breast lesions are composed of minute multiple cysts lined by uniform flat or cuboidal to columnar epithelium. Microscopically, microcalcifications are frequently present within the cysts and extravasated mucus. These lesions may mimic the microcalcifications of ductal carcinoma *in situ* at screening mammography.

Method: A review of the multidisciplinary breast clinic database revealed 20 cases of mammary mucocele-like lesion diagnosed at Royal Perth from January 1996 to December 2001.

Results: All lesions presented as impalpable mammographic screen detected lesions. Nineteen lesions presented as clusters of irregular calcification mimicking ductal carcinoma; one lesion presented as a complex cystic mass at mammography and ultrasound. Fine needle aspiration yielded mucinous material. Core biopsy confirmed mucocele-like lesion in 15 lesions. Seventeen women underwent open biopsy following hook-wire localisation.

Discussion: Mammary mucocele-like lesions are rare screen detected lesions that may calcify and mimic ductal carcinoma *in situ* or present as complex cystic masses. Fine needle aspiration of mucinous carcinoma and mucocele-like lesions may yield mucin with scant epithelium. Core biopsy or excisional biopsy is recommended to differentiate between these lesions.

19 Sloane Project: a prospective audit of screen detected ductal carcinoma *in situ*

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One thousand nine hundred and fifty-three non-invasive breast cancers were diagnosed by the National Health Service Breast Screening Programme (NHSBSP) in women aged 50–64 during the period 1999–2000. Prior to the introduction of screening only 295 cases of ductal carcinoma *in situ* (DCIS) were recorded in England and Wales in women in the same age band. The reason for this is that the trademark characteristic of microcalcification in the majority of DCIS cases is easily visualised radiologically on a mammogram. Consequently, with the introduction of breast screening, the incidence of this type of cancer has been increasing rapidly, and DCIS now accounts for approximately 20% of all cancers detected by the NHSBSP.

The invasive potential of each DCIS is uncertain and accordingly the optimal method of treatment in every case is unclear. The Sloane Project aims to address this question. As a prospective audit recording particular characteristics in terms of radiological and pathological appearance and details of surgical and adjuvant treatment, the audit will compile a database of potentially 6,000 DCIS cancers over 3 years. These women will be followed up and the incidence of local recurrence, meta-

stases and deaths will be determined. This information will allow us to calculate survival, to suggest what might be the optimal treatment for DCIS, to identify prognostic indicators and to examine the role of margins and adjuvant therapy on outcome.

20 Electrical impedance scanning: a new imaging technique for evaluating microcalcification in the breast?

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Objective: Electrical impedance scanning (EIS) is a new imaging modality that utilises the different dielectric properties of malignant and benign cells. The aim of the study was to evaluate the efficacy of EIS in the evaluation of clinically occult microcalcification in the breast.

Method: Women with areas of clinically occult microcalcification detected on X-ray mammography underwent EIS of the breast. A targeted high-resolution mode was used to assess the area of microcalcification. A bright white spot over the area of microcalcification was interpreted as a positive result. The EIS data were also analysed by post-processing, evaluating peak and average capacitance and conductivity over the region of interest compared to a normal control area in the same breast.

Results: Thirty-five women were recruited (mean age 57, range 42–74 years). Histological diagnosis ($n = 29$) revealed: invasive disease ($n = 1$), invasive + ductal carcinoma *in situ* (DCIS; $n = 4$), DCIS ($n = 4$) and benign ($n = 20$). The remaining patients ($n = 6$) had radiologically benign microcalcification requiring no formal histological assessment. For the detection of malignancy using EIS imaging alone the sensitivity, specificity, positive and negative predictive values were 44.4%, 53.8%, 25.0% and 73.7%, respectively. Post-processing analysis improved the overall accuracy, with corresponding values of 55.6%, 88.5%, 62.5% and 85.2%. The difference in mean conductivity between malignant and benign lesions in the white spot region of interest was significant ($P = 0.034$).

Conclusion: EIS is able to differentiate malignant from benign disease associated with clinically occult microcalcification.

21 Assessment of full field digital mammography (FFDM) detected microcalcification is not hindered by low spatial resolution

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Background: Full field digital mammography (FFDM) seems set to replace conventional film-screen technique. Concern has been raised over FFDM diminished spatial resolution (5–6 lp/mm). If valid, this could compromise detection of calcification and diagnosis of ductal carcinoma *in situ* (DCIS). However, in our centre we were not able to perceive any difference between microfocus magnification and on-screen magnification when assessing microcalcification.

Aim: To evaluate replacement of analogue microfocus technique by on-screen digital magnification for microcalcification, and to analyse the relative importance of spatial resolution *versus* contrast detail test scores.

Methods: We performed phantom image quality testing on our digital unit (GE 2000D), using the TORMAX and TORMAM phantoms. We subsequently compared these results with average scores for over 90 film-screen mammography systems.

Results: Although our digital unit had a lower spatial resolution (6–7 lp/mm) than the film-screen systems (up to 15 lp/mm), both TORMAX and TORMAM scores were superior for digital soft-copy reporting compared to hard-copy reporting, film-screen technique and analogue microfocus magnification.

Conclusion: Despite lower spatial resolution, the superior contrast and image manipulation abilities of FFDM obviate the need for conventional microfocus magnification in the radiographic work up of microcalcifications. Sufficient information is provided on FFDM upon which to base a decision to proceed to diagnostic interventional procedures such as core biopsy or mammotome excision.

22 Computed radiography systems for mammography: an evaluation of image quality and dose

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Computed radiography (CR) in mammography was initially based on systems for general radiography. Dedicated mammography CR systems are now available with improved imaging capability, particularly in terms of spatial resolution. The phosphor is carried on a clear backing plate and the reader scans both sides of the phosphor simultaneously.

Image quality data for both types of mammography CR system was obtained using standard test objects. All acquired images were printed onto film using a high-resolution laser printer and were scored under standard viewing conditions. Certain images were also scored as soft copy using a reporting workstation. Breast dose was also assessed. The results were compared to film screen data and to the National Health Service Breast Cancer Screening Programme (NHSBSP) guidelines on the introduction of CR systems for mammography.

In terms of low contrast sensitivity and small detail detectability the performance of both designs of CR system is similar to that of a modern film screen combination. The measured values of high contrast resolution are close to the nominal values derived from the pixel size but are significantly poorer than for film screen imaging. Dose levels are similar to that for a modern film screen combination. Both CR systems meet the suggested NHSBSP standards for image quality and dose.

23 Predicting breast cancer response to chemotherapy using quantitative magnetic resonance (MR) imaging

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Change in tumour volume may be a relatively late manifestation of chemotherapy response in patients with inoperable breast cancer. Recent studies suggest that quantifying water apparent diffusion coefficient (ADC), microvessel permeability (K^{trans}) or water to fat signal ratio (WFR), using magnetic resonance (MR) imaging or spectroscopy, may provide an early indication of ultimate treatment response.

Imaging and spectroscopy were carried out prior to chemotherapy (TP0) and shortly after the second (TP2) and final courses. ADC was measured using echo planar imaging (EPI) (maximum diffusion gradient weighting 680 s/mm^2); K^{trans} was measured using dynamic T_1-weighted gradient echo imaging (13 s temporal resolution); WFR was measured using stimulated echo acquisition mode (STEAM) spectroscopy (TE 135 ms); tumour volume was measured using high resolution, three dimensional, post contrast, fat-suppressed images (manually traced regions of interest).

Preliminary results from five (of 35 recruited) women who have completed their chemotherapy course (standard regimen involving 5-fluorouracil, epirubicin and cyclophosphamide) demonstrated that all tumours responded. Both the TP2:TP0 MRI volume ratio and the corresponding K^{trans} ratio accurately predicted response in all five cases. The corresponding ADC and WFR ratios predicted response in three out of five and four out of five cases, suggesting that they may be less reliable indicators of final treatment efficacy. Results from 25 out of 35 women (course completed) will be presented.

24 Our experience in using magnetic resonance imaging (MRI) as an adjunct to mammography and ultrasound in assessing response to neoadjuvant chemotherapy

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Objectives: (1) Did early magnetic resonance imaging (MRI) correctly identify 'responders'? (2) Did MRI at the end of treatment correctly identify residual disease?

Method: Patients were assessed with mammography, ultrasound and MRI prior to treatment and had a second MRI scan after two pulses of chemotherapy. Mammography, ultrasound and MRI were then repeated at the end of treatment. Response at MRI was determined by a combination of size, morphological appearance and enhancement profile.

Results: Eleven patients were studied. Four patients presented with primary breast tumour and clinically enlarged axillary lymph nodes. Seven patients presented with large tumours (>30 mm). Patients were divided into responders/non-responders based on a greater than 50% reduction in size at mammography and ultrasound at completion of treatment. In the first group, there were three responders and one non-responder. In the second group, there were four responders and three non-responders. All responders were identified at the early MRI scan. All patients had residual disease at surgery. MRI was a useful adjunct to mammography and ultrasound but still tended to underestimate the extent of residual disease.

Conclusion: (1) MRI provides additional information about the extent of disease before and after chemotherapy treatment. (2) Early MRI (after two pulses) predicted response to chemotherapy.

25 Evaluation of three different resolution workstations for reporting computerised radiography mammographic images

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Using Fuji computerised radiography and a General Electric PACS our unit now reports soft copy mammography images. These are available for reporting on three monitors, a Pathspeed Diagnostic 2A workstation with two monitors each with 1728 × 2304 pixel resolution, a Pathspeed Diagnostic 2B with two monitors each with 1200 × 1600 pixel resolution and an image review workstation (IRW), which constitutes a Dell PC with a 17" flat panel LCD screen with 1024 × 768 pixel resolution. Mammography reporting has traditionally been felt to require the best possible resolution. This study has been designed to show whether or not this is necessary.

We have evaluated standard mammography phantom images (TORMAS and TORMAM) and a set of 50 mammograms with known calcification to determine the resolution required for reporting CR mammography. This has implications for other units interested in computerised radiography as the costs of the three reporting workstations range from £1,000 to £41,000.

26 Ductal carcinoma *in situ* (DCIS)

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Does the detection and proper treatment of ductal carcinoma *in situ* (DCIS) contribute to mortality reduction? In other words, does the detection of DCIS prevent the development of metastatic invasive cancer and thereby death? Although we assume that DCIS is the obligate pre-stage of most invasive breast carcinomas, it is unlikely that all DCISs have the potential to progress to an invasive process within the lifetime of the patient. This assumption is based on histologic review studies indicating that certain types of DCIS (the well differentiated types) have a limited risk of progressing to an invasive cancer. Recently, Böcker reported close genetic similarity of well, intermediately and poorly differentiated DCISs and distinct morphologic types of invasive breast cancers. Further, Lampejo *et al*. reported a significant difference in disease-free survival and overall survival for patients with invasive tumours with different types of DCIS components. Patients with poorly differentiated DCIS components had a poor prognosis and those with well differentiated DCIS components had a very good one. We may conclude that all fully developed DCISs have the potential to progress to an invasive cancer. The time needed for this process, however, is different for the poorly and well differentiated subtypes. For the majority of the poorly differentiated DCISs this may take less than 5 years, while for the well differentiated type it probably takes more than 10–15 years. Poorly differentiated DCIS is the precursor of high-grade, and well differentiated DCIS of low-grade invasive cancer. Therefore, the detection of the poorly and intermediately differentiated DCIS is more important in terms of effect on mortality than the detection of the well differentiated subtype.

27 Invasive cancer

IO Ellis

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Breast screening detects a wide spectrum of breast cancer, ranging from microfocal low-grade ductal carcinoma *in situ* (DCIS) to large high-grade invasive cancer (Cowan *et al*., 1991; Klemi *et al*., 1992; Rajakariar *et al*., 1995). It has been proposed that detecting *in situ* cancer, particularly high-grade DCIS, would prevent the development of high-grade invasive cancer (Lampejo *et al*., 1994; Evans *et al*., 1997, 2001). It is well recognised that many low-grade, special invasive cancers are identified at screening (Cowan *et al*., 1991; Klemi *et al*., 1992; Porter *et al*., 1999). Such tumours have an excellent prognosis but may be so indolent that they would never have presented clinically or have threatened the life of the patients. It has been proposed alternatively that a proportion of these low-grade invasive tumours might de-differentiate over time into more aggressive, less well differentiated tumours (Tabár *et al*., 1999), although this was not found in another screening programme (Hakama *et al*., 1995). Identification and removal of such cancers when they are at a low-grade would avoid such progression. Detection of high-grade invasive cancers when they are small is clearly a means by which screening could reduce breast cancer mortality. In support of this possibility, it was shown in the two-county trial in Sweden that histological grade 3 invasive cancers detected when less than 10 mm have an excellent prognosis (Tabár *et al*., 1999), while it is widely recognised that large high-grade invasive cancers have a poor prognosis. In addition the presence of vascular invasion and lymph node metastasis, which are associated with development of metastatic disease, are rare in grade 3 tumours <10 mm, grade 2 tumours <10 mm and grade 1 tumours <20 mm, indicating that detecting tumours under a certain size should be beneficial (Evans *et al*., 2001).

28 The epidemiologist's perspective

SW Duffy

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By examining the stage-shifts in mammographic screening trials, and the fatality rates by stage, one can derive estimates of which cancers detected at screening save most lives. We partition the mortality avoided by screening into deaths prevented by stage-shifting from invasive carcinoma of stage II or worse to invasive carcinoma of stage I, and those prevented by shifting from invasive carcinoma of stage I to ductal carcinoma *in situ*. Using data from the Swedish Two-County Study, we find that around 5% of the deaths avoided in the invited arm were prevented by detection of ductal carcinoma *in situ* and around 65% by stage-shifting from stage II+ to stage I within the invasive carcinomas. Further results by tumour type and grade are presented to quantify the size and timing of the future mortality reduction from the cancers diagnosed.

29 Vacuum biopsy in the UK

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The first vacuum-assisted core biopsy (VACB) apparatus in the UK was installed for clinical use with stereotactic guidance at King's College Hospital in 1998. Since then it has been incorporated into routine clinical practice for the assessment of non-palpable mammographic abnormalities, particularly microcalcification and areas of architectural distortion not visible on ultrasound examination, and more than 150 VACB procedures are carried out per year. There are now more than 50 VACB units in use in the UK.

The potential advantages of VACB over standard 14G core biopsy are:

1. Larger samples obtained
2. No repeat insertion of the needle necessary
3. Haematoma evacuated during the procedure
4. More tissue available for histological examination
5. Sampling effective when probe positioned several millimetres away from the lesion
6. Improved calcium retrieval rates, particularly from small clusters of indeterminate microcalcification
7. Fewer equivocal (B3, B4) results
8. Improved sensitivity for detection of invasive carcinoma in an area of ductal carcinoma *in situ*
9. Marker clip deployment when mammographic marker is removed.

The results of published studies together with data from the UK trial of 14G core biopsy *versus* 11G mammotome will be discussed, and a strategy for future development of the use of VACB in diagnostic and assessment centres in the UK will be suggested.

30 Therapeutic applications of vacuum biopsy

ARM Wilson

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Core biopsy is now established as the first-line method for breast biopsy and sensitivity for carcinoma of 90–95% can be achieved. The quest for 100% accuracy of percutaneous biopsy has led to the development of very large core biopsy methods; vacuum assisted mammotomy (VAM) is the most successful and widely used of these methods. VAM is available in 14, 11 and 8 gauge sizes (36, 100 and 300 mg per core). The 8-g probe has been developed specifically for attempted complete removal of small breast lesions. VAM is not suitable for excision of malignant lesions but has a role in the removal for diagnosis of borderline lesions and removal of confirmed benign lesions at the patient's request. Borderline lesions suitable for VAM removal are papillary lesions, mucocele-like lesions and radial scars. Nipple discharge associated with intraduct papilloma can also be treated by this method. VAM can also be used to excise fibroadenomas up to 30 mm in diameter. VAM is well tolerated and has very few complications. For therapeutic excision VAM is significantly cheaper than surgical biopsy.

31 Multicentre evaluation of stereotactic vacuum biopsies of mammographically indeterminate or suspicious lesions

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Purpose: Vacuum biopsy (VB) promises excellent accuracy for indeterminate lesions, including microcalcifications. The purpose of this study is to check reproducibility and reliability in high quality breast centres.

Materials and method: From January 1996 to December 2000, more than 1,700 stereotactically guided vacuum biopsies (SVBs) were performed in five breast centres using a defined standard. The data shown here are based on an ongoing evaluation (presently 89% completed). Indications were ACR III 16%, ACR IVa (moderate suspicion) 63%, ACR IVb (suspicion) 63% and ACR V 5% of the cases.

Results: An additional 1.5% examinations were scheduled but not performed (lesion too close to chest wall, microcalcifications not resolved). Among performed studies the examination was terminated due to technical problems in 0.9% (90% due to one biopsy table), bleeding (0.4%), or pain (0.1%). Nine per cent of cases proved to be invasive carcinomas, 13% ductal carinoma *in situ* (DCIS) and 4% atypical ductal hyperplasia (ADH). In four benign lesions the pathologist recommended excisional biopsy, which confirmed the diagnoses. In the 73% benign lesions diagnostic surgery could be avoided.

Conclusion: Standardised stereotactic VB is very accurate, safe and cost effective.

References

1. Heywang-Köbrunner SH, *et al.*: **Minimally invasive stereotaxic vacuum core breast biopsy.** *Eur Radiol* 1998, **8**:377-385.
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3. Schulz-Wendtland R, *et al.* **Interventionelle methoden in der mammadiagnostik.** *Gynäkol Prax* 2002, **26**:63-78.

32 The effect of screening across the age spectrum

SW Duffy

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Historically, the most hotly disputed issue in mammographic screening is whether to screen the age group 40–49. The most recently published combined analysis of the randomised trials of breast cancer screening at a range of ages between 40 and 74 gives a 24% reduction in breast cancer mortality in association with invitation to screening. The most recent combined analysis of the trial results for women aged 40–49 at randomisation shows a significant 18% reduction in association with invitation to screening. The effect in those who actually receive screening may be considerably greater. Evaluation of service screening programmes similarly suggests a mortality benefit in women aged 40–49. To achieve this benefit a greater commitment of financial and human resources is required. The decision to offer organised screening before age 50 will always vary, depending on the incidence in this age group, societal attitudes and competing calls on resources. However, breast cancer control in this age group is a major issue, because the proportion of deaths due to breast cancer is higher among younger women than among older women. The age at which to stop screening is a less researched question and a more difficult one. It is clear that there is a benefit of screening women up to age 70, but how long that benefit lasts if screening ceases at age 70, and what sort of non-intensive regimen might be offered to older women is not clear. Some tentative answers to these questions are proposed.

33 Progress report on integrating skill mix: the radiologist's perspective

ERE Denton

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The 4-tier model for new ways of working in breast radiography has now been in place for 2 years. The role of the assistant practitioner is established and eight practitioners are in post.

Advanced practitioners remain diverse, with differences in role extension appropriate to the departments where they work. The role of the lead practitioner has yet to be clearly defined.

I will explore the experiences of the four pilot sites, particularly with regard to their differing needs for advanced practitioners. I will discuss the training and continuing professional development for radiographers undertaking this role extension.

34 Progress report on integrating skill mix: the radiographer's perspective

B Young

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Radiographers are the core people required in developing the proposed '4 Tier Structure' of the National Health Service Breast Screening Programme (NHSBSP) Skill Mix Project.

Radiographers are needed to train and supervise the level one tier, assistant practitioners. These people will have, in the main, little or no experience of breast units or even radiography, and will need quite close and detailed supervision.

Radiographers will still, in most units, remain as the lynchpin workers in the screening and symptomatic clinics, at least for the next few years while the level one workers are being trained. These radiographers will be essential for maintaining the service at its present level and for the future extension and expansion of the programme.

Suitably enthusiastic radiographers will be required to train into the advanced level practices as identified by their particular units. In time and with proper training it may be that the future lead practitioners within this 4-tier structure will be radiographers.

35 Progress report on integrating skill mix: the college perspective

A Cattell
The College of Radiographers, London, UK

Pilot testing of the '4 Tier Structure' for radiography in mammography screening has been completed in four sites. A number of positive outcomes have been identified and there are proposals to introduce the model to other sites. A framework for pay and conditions of service for radiographers at all levels will be presented to underpin the new structure. The scope of the pilots included development of all four tiers, including lead/consultant practitioner.

Criteria for consultant therapists have been developed and guidance for employment issued by the Department of Health. The paper will discuss the opportunities for the consultant radiographer role within the screening service and consider the implications for future service delivery.

36 Extent and stage of breast cancer

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The extent and stage of breast cancer at initial presentation determines treatment options and prognosis. Pre-operative disease extent is determined by mammography and image guided biopsy, although magnetic resonance imaging (MRI) may show further multifocal or multicentric disease. Histological assessment will give tumour size, type, grade, hormone receptor status and the presence of vascular invasion; however, a variety of imaging techniques can contribute to this information and perhaps give an *in vivo* functional assessment of tumour physiology. Lymph node involvement has been shown to have important prognostic status and is assessed by surgery or sentinel node biopsy. Ultrasound, MRI and nuclear medicine techniques, including positron emission tomography (PET), give variable results in the assessment of the axilla. Clinical assessment of tumour response in the neo-adjuvant setting is unreliable and imaging can more accurately measure tumour size and residual disease.

The contribution of mammography, ultrasound and MRI will be discussed together with a review of the potential contribution of the less commonly used nuclear medicine techniques and PET. The functional imaging techniques are being explored and may be used in the future to tailor patient management, particularly in the use of chemotherapy.

37 Recording breast screening decisions: human factors and new technology

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The Personal Performance in Mammographic Screening (PERFORMS) self-assessment scheme was designed to give radiologists insight into their own breast screening diagnostic performance skills. Originally conceived solely as a paper-based approach, the scheme has been very successful and consequently has expanded. Currently, a handheld computer is utilised, both to record an individual's opinions about each case examined and to provide some initial immediate feedback on the accuracy of their decisions. Unfortunately, the complexity of the scheme has now far outstripped the recording technology used, which affects both current usability and limits future enhancements. This paper describes the factors involved in the redesign of a new state of the art system for recording radiologists' decisions in breast screening that could have more widespread applicability outside the self-assessment scheme.

Human factors methods have been implemented to analyse users' needs and determine the hardware requirements. A wide range of potential systems have been considered, including voice-operated, augmented reality and tablet computers. The availability of a Windows-based Webpad provides the opportunity of developing an easy to use system that can provide expanded information to the radiologist. Ongoing studies are investigating the design of the final user interface, and launch of the new system is anticipated in 2003.

38 Image features of true positive and false negative cancers in screening mammograms

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The location, tissue background and imaging characteristics of true positive and false negative screens of breast cancers have been studied. These data can aid decisions in optimising the display of mammographic information, with the objective of minimizing false negative screens. Screening mammograms for four groups of women were digitised: those with screen detected cancers, those with false negative interval cancers, and matched normals for both groups. The optical density (OD) distribution in the main breast region of each mammogram was determined. The OD in three regions of interest around the cancers were also measured: corresponding to the cancer centre, its outline, and a ring of background tissue. Cancer locations were mapped and warped onto a typical image. Where a cancer was detected by calcifications alone it had a relatively low probability of being a false negative interval cancer. The mean OD differences between the cancer and the cancer background region were approximately a factor of two lower in dense breasts rather than in other breast types. Poorly defined masses that became interval cancers had mean OD differences that were approximately of 0.1 OD lower than those that were detectable by screening. Of the false negative cancers 22% were located near the chest wall edge of the mammograms, compared to 10% of the true positives. The results indicate the importance of effectively displaying information in the lighter areas of the mammogram, corresponding to glandular tissues. Where the cancer mean OD differences are low, as measured for some poorly defined masses, there is an increased risk of a false negative interval cancer. Particular attention should be given to the chest wall area of the film, especially in the lower retroglandular region, during routine screening.

39 Comparative effectiveness of magnetic resonance imaging in breast cancer (COMICE trial)

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The overall aim of the comparative effectiveness of magnetic resonance imaging in breast cancer (COMICE) trial is to determine the potential benefits of the addition of magnetic resonance imaging (MRI) to the routine techniques employed for loco-regional staging of primary breast cancer, to both the patient and the National Health Service.

The study objectives are to evaluate the role of MRI in reducing the re-operation rates following primary excision between those planned by conventional triple assessment and those planned by triple assessment plus DCE MRI. Additionally, an economic evaluation from a societal perspective of the cost-effectiveness between the two arms will be performed.

The study design consists of a multicentre, randomised, controlled, open, fixed sample, parallel group trial with equal randomisation, of women with biopsy proven primary breast cancer who are scheduled for wide local excision. Patients (1,850) will be randomised to receive MRI or no further investigations. A pragmatic approach to trial design has been chosen so that results will be generalisable in clinical practice and to reduce unnecessary trial costs that are protocol driven.

Additional factors examined include the following: studying ipsilateral breast tumour recurrence rates; subsequent chemotherapy/radiotherapy rates; quality of life issues; risk factors for referral for MRI; accuracy of loco-regional staging; percentage of patients undergoing a change in clinical management after MRI; and follow up of MRI only detected lesions.

40 Magnetic resonance imaging (MRI) in the assessment of patients with breast carcinoma: an audit of accuracy

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The aim of this audit was to assess the accuracy of breast magnetic resonance imaging (MRI) in patients with biopsy proven breast carcinoma. Indications were detecting multifocal disease, assessing extent of primary tumour and excluding recurrence.

Nineteen patients with known breast carcinoma detected on mammography, ultrasound or clinical examination were referred for MRI at 1T with bilateral breast coils. Pre-contrast and dynamic post contrast scans with subtraction were performed.

Nineteen patients had 21 histologically proven lesions. These included 13 invasive ductal carcinoma, two invasive lobular carcinoma, one medullary carcinoma and five benign lesions. MRI detected all of these and eight new lesions. Histological confirmation was available on two of eight new lesions detected by MRI. These represented 5- and 7-mm foci of invasive ductal carcinoma, one correctly predicted to be malignant in the contra-lateral breast. The other, thought to be benign, was removed at wide local excision of the known carcinoma. Six of the eight lesions had benign MRI features. Eleven months of clinical follow up revealed no abnormality.

Two follow up scans following surgery and radiotherapy were normal. Nine months of clinical follow up revealed no recurrence. We concluded that breast MRI is a reliable adjunct in pre-operative assessment and follow up of patients with known carcinoma.

41 Breast magnetic resonance imaging (MRI) – common pitfalls: a pictorial representation

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1. Movement artefact: an apparent enhancing lesion on the subtraction images must be confirmed on the pre-subtraction series.
2. Vessels: tortuous vessels can be misleading. Three-dimensional reconstruction is useful in differentiating vessels from focal nodules.
3. Lymph nodes: normal intramammary lymph nodes enhance and do not always have a typical 'C' shape. Review of the mammogram can be useful.
4. Lobular carcinomas: magnetic resonance imaging (MRI) is particularly useful in diagnosing EXTENT of this difficult tumour subgroup. The enhancement profile, however, is often benign with slow and modest uptake. It is particularly important to review the MRI in conjunction with the triple assessment.

42 Roadworks ahead: a collaborative approach to process redesign

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The symptomatic breast service at James Cook University Hospital has recently undergone a pathway review, the catalyst for the review being the Cancer Services Collaborative (CSC) Phase II programme, which began in April 2001. A pathway review had previously taken place in 1998, with one of the aims being to provide a one-stop clinic allowing regular analysis of variants to prove clinical effectiveness and service efficiency. Due to service pressures, one of which was the impact of the 2-week wait, not all patients requiring the one-stop service could receive triple assessment. This was in the main due to lack of clinic time along with mammography and ultrasound availability. Using the CSC methodology the current process was mapped, redesigned and audited. The changes have resulted in: extending the new patient clinic, with greater mammography and ultrasound availability; where patients require ultrasound and mammography outside the clinic appointments can be booked within the clinic. The MDT has been moved from prior to the breast clinic to post clinic, allowing more timely discussion of patients both before and after surgery. Acquisition of a computer printer, projector and network facilities for the MDT has resulted in the ability to enter data in real-time and generate referrals to Oncology.

43 Quality management in the 21st century

S Munslow and MG Wallis
Breast Screening Unit, University Hospitals Coventry & Warwickshire NHS Trust, Coventry, UK

Quality management systems in the 21st century should not be unwieldy and over-documented tomes, but should be used to reflect the organisation's policy, objectives and commitment to quality.

Quality management systems should be used as the basis for continually improving business performance with a more flexible 'process based' management approach rather than the earlier, somewhat regimented, 'system based' style.

Our aim, through the use of illustration, is to provide an informative view of the requirements of the 21st century quality management system [1] and the role and responsibilities of the quality manager.

Reference

1. IS09001: 2000: Quality Management System Requirements.

44 It ain't what you do, it's the way that you do it – that's what gets results

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Getting the right result to the right woman has featured heavily in the past 12 months. All breast screening services have been called upon to ensure that they have adequate safeguards in place to support the 'right results' process. Coventry's approach through its quality management system was fortified by process mapping exercises. Maps are used to illustrate how work gets done in an organisation. They represent a snapshot in time that shows the specific combination of functions, steps, responsibilities and timelines. They can also identify significant opportunities for improvement. Coven-

try's approach was benchmarked for use by the National Co-ordination Committee for administration and clerical staff within breast screening and has been successfully adapted for the breast screening services in the West Midlands region. This informative visualisation is used to illustrate the process.

45 Is pre-operative ultrasound assessment useful in the diagnosis of radial scars (RS)/complex sclerosing lesions (CSL)?

DC Windmill, RM Watkins, PA Jones and JR Steel

Primrose Breast Care Centre, Derriford Hospital, Plymouth, UK

Many screen-detected radial scars (RS)/complex sclerosing lesions (CSL) are associated with malignant disease. The role of ultrasound in pre-operative evaluation is uncertain. Our aim was to determine whether ultrasound was able to detect associated pathology in such lesions. The ultrasound scans of 38 women (age range 37–65 years) with a definitive diagnosis of RS/CSL at excision biopsy were reviewed by one radiologist who was blinded to the identity of the patients and their previous ultrasound reports. Eight features were reviewed and, based on these, a probability of malignancy was recorded on a scale of 1 to 10. The radiologist's report and definitive histology were compared. Lesions were not visible on ultrasound in eight patients (21%). Three patients had invasive carcinoma; their scores were 8, 7 and 2 (mean 5.7). Of two patients with ductal carcinoma *in situ*, scores were both 6. Combining the scores for those with associated malignant pathology gave a mean score of 5.8. The mean score of patients with benign RS/CSL was 4.7. Three ultrasound features were found in all cases with associated malignant disease; posterior shadowing, an hypo-echoic margin and the absence of microlobulation. However, these were also present in the majority with benign RS/CSL. Ultrasound tended to underestimate the size of the lesion, independent of its nature.

Pre-operative ultrasound cannot reliably predict the presence of pathology associated with RS/CSL, but a larger series is required to confirm these findings.

46 Can ultrasound reliably localise radial scars (RS)/complex sclerosing lesions (CSL) prior to excision biopsy?

DC Windmill, JR Steel, PA Jones and RM Watkins

Primrose Breast Care Centre, Derriford Hospital, Plymouth, UK

Traditionally, mammography has been used to localise radial scars (RS)/complex sclerosing lesions (CSL) prior to excision biopsy. Our aim was to evaluate the adequacy of pre-operative ultrasound. Fifty-eight consecutive women (age range 36–72 years) who had a definitive diagnosis at excision biopsy of RS/CSL were identified between January 1997 and January 2002. Twenty-eight patients underwent pre-operative ultrasound (US) localisation and 30 mammographic (MG) localisation (29 wire and one surface marker). The size of the lesion, weight of specimen and adequacy of excision were recorded. Successful localisation was achieved in all patients. In patients with an entirely benign RS/CSL the median size of the lesion was 14.5 mm (range 9–20 mm) in the US localisation group and 11 mm (range 4–20 mm) in the MG localisation group. Median weight of the specimens was 16 g (range 6–65 g) in the US group and 15 g (range 7–45 g) in the MG group. Eight (35%) of 23 biopsies were greater than 20 g in the US group compared with five (19%) of 26 in the MG group. By Fisher's exact test there was no significant difference ($P = 0.3320$). In patients with malignant disease associated with a RS/CSL, re-excision was required in one of three in the US group and two of four in the MG group.

Pre-operative US localisation compares favourably with MG techniques for excision biopsy of RS/CSL.

47 An extended role for ultrasonographers in the evaluation of breast disease: initial experiences

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Aims: With the continuing increase in workload of breast assessment units, the role of specially trained ultrasonographers able to perform unsupervised invasive procedures remains unclear.

Method: Between January and December 2001, patients from the Hull and East Riding Breast Care Unit underwent invasive procedures performed under ultrasound control by a specially trained ultrasonographer.

Results: Seven hundred and twenty-eight procedures were performed (age range 12–90, mean age 53 years), which included 175 fine needle aspirations (FNAs) and 389 core biopsies. The histology/cytology results were malignant in 230, suspicious of malignancy in 8, benign but uncertain of malignant potential in 29, benign in 231 and unsatisfactory/normal tissue in 66. Of the FNAs, 20.9% were considered inadequate (acceptable level <25%, National Health Service Breast Screening Programme). Further ultrasound-guided procedures

included 20 successful wire localisations, 124 aspirations of cysts and 13 abscess aspirations. In this series one patient suffered a haematoma following a core biopsy.

Conclusion: We conclude that extending the role of ultrasonographers is safe, consistent with current diagnostic requirements and is an appropriate use of resources for the future.

48 Comparison of image quality between mammograms performed by an assistant practitioner and by screening radiographers

AE Tuson, D Seddon, CA Hopkins and AJ Maxwell

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Bolton is one of the four national development sites for skill mix in the UK National Health Service Breast Screening Programme. Two assistant practitioners have been trained in-house to perform mammography; one (AET) commenced training in September 2000, and the other in April 2001. AET has now been performing mammography under indirect supervision for several months.

Fifty mammographic examinations performed recently by AET and 50 performed by radiographers with the Certificate of Competence in Mammography were randomly selected. All 100 examinations were performed in the same screening unit over the same period of time. Examinations on 'difficult' women (e.g. in a wheelchair) were excluded as these would not be performed by an assistant practitioner. The examinations were randomly mixed and the mammographers' identifiers on the films obscured. The oblique views were assessed by an experienced radiographer (DS) using a simple satisfactory/unsatisfactory scoring system for each of nine variables.

The images produced by the assistant practitioner were slightly less likely to be symmetrical, but otherwise there was no significant difference in the quality of the images produced by the assistant practitioner compared with those produced by the radiographers. The findings confirm that assistant practitioners can make a valuable contribution to the Breast Screening Programme.

49 Great, I've been let off the hook (the impact of advanced practice within the breast screening department)

C Lewis and MG Wallis

Warwickshire, Solihull & Coventry Breast Screening Unit, Coventry & Warwickshire Hospital, Coventry, UK

The role of advanced practitioner enables the radiologist to work more efficiently. Wire localisations are essential procedures but by using a radiographer who has been trained to undertake them, this leaves the radiologist time to film read without interruption most mornings.

As the advanced practitioner can perform stereocores, the assessment and symptomatic clinics are able to run more efficiently. The outcome is to minimise stress, streamline the service and promote a patient-focused quality service (i.e. shorter waiting times for results, minimise repeat attendance).

Audit of these procedures for radiologists and radiographers indicate that the results are very similar.

A radiologist commented, "It's great, I've been let off the hook! Peace to read most mornings."

50 Technical recalls and technical repeats: evaluating the effect of the Occupational Standards/Skill Mix project

ME Wheaton and V Gilks

Warwickshire, Solihull & Coventry Breast Screening Unit, Coventry & Warwickshire Hospital, Coventry, UK

As a pilot site for the Occupational Standards/Skill Mix project, it was agreed at the outset that one of the evaluation criteria would be the effect the project had on our technical recall and technical repeat rate. In particular, concern has been raised that trained assistant practitioners may have a higher technical recall/repeat rate than trained radiographers.

Technical recall and repeat data are routinely collected and documented by all mammographers working within our service and stored on the National Breast Screening Computer System (NBSS). These data are analysed monthly for technical recall rate, technical repeat rate and overall rate, including individual mammographers' rates, using a co-writer report from NBSS.

We are currently performing a detailed evaluation of these rates for the 3-month period following the completion of the project, specifically comparing the technical recall/repeat rates of the two newly trained assistant practitioners with two newly trained radiographers, to see if the concern is justified.

51 National Vocational Qualifications (NVQs): a learning experience

V Gilks and J Ng
Warwickshire, Solihull & Coventry Breast Screening Unit, Coventry & Warwickshire Hospital, Coventry, UK

As a pilot site for the Occupational Standards/Skill Mix project in breast screening, the Warwickshire, Solihull and Coventry Breast Screening Service appointed two trainee assistant practitioners. Besides their practical mammography training, it was decided they should follow the National Vocational Qualification (NVQ) award course 'Diagnostic and Therapeutic Support in Care' level 3. This type of learning was new to us and probably new to most breast screening and X-ray departments.

We present a short explanation of the NVQ system, together with a description of benefits to others who may be contemplating following in our footsteps.

52 Extending the screening programme: how we did it and lived to tell the tale!

V Gilks and ME Wheaton
Warwickshire, Solihull & Coventry Breast Screening Unit, Coventry & Warwickshire Hospital, Coventry, UK

As a pilot site for the Occupational Standards/Skill Mix project, by Christmas 2000 we had become aware that this also meant that we were expected to extend the screening programme up to the age of 70 and introduce two views on all women, before the end of March 2002. This poster takes a light-hearted pictorial view of our journey from then to 4 February 2002 and beyond.

53 Assistant practitioners: a success story

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The objective of this poster is to show how assistant practitioners fit into a busy breast-screening department. Four support workers were employed from August 2001, all having care related backgrounds. It was unclear at the outset exactly what their duties would be and to whom they would be responsible on a day-to-day basis. The girls were all placed on a National Vocational Qualification (NVQ) course level 3 in Diagnostic and Therapeutic Support on an accelerated basis to complete in 9 months instead of 12, and four radiographers are currently undertaking NVQ Assessors awards in order to support them. The first 3 months were difficult for both staff and trainees, and they were employed according to the department's needs. One girl ultimately made the decision that the job wasn't for her. The girls started mammography training in January 2002, each one working one-to-one with a trainer for 2 weeks initially and with regular reviews, and all are producing good quality mammograms. They also undertake nursing, processing and office duties where possible. Our three remaining girls have been renamed assistant practitioners after the Occupational Standards were set and are a great asset to our department in all the areas they work in.

54 Complications of breast core biopsy

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A pictorial review of some of the complications of breast core biopsy is presented. Core biopsy of the breast is a commonly performed procedure that plays a vital role in the investigation of suspected breast cancer. Serious complications related to it are rare. The commonest problem is bleeding, which is usually easy to control at the time of the procedure. Arterial bleeding usually leads to the procedure being abandoned and repeated later. Applying pressure normally brings arterial bleeding under control within 15 min. Lesser degrees of haematoma can result in the lesion being obscured, which prevents a representative biopsy being obtained. In these cases repeat biopsy after an interval of 2 weeks allows the haematoma to resolve.

Rarer complications of core biopsy include infection and abscess formation, pneumothorax, milk fistula formation, cosmetic deformity and seeding of tumour along the biopsy track. Complete removal of a mammographic abnormality such as microcalcifications can result in difficulty if localisation for excision is required.

55 Pre-operative fine-needle aspiration cytology (FNAC) and core biopsy (CB) of radial scars (RS) and complex sclerosing lesions (CSL)

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Many screen-detected radial scars (RS) and complex sclerosing lesions (CSL) are associated with malignant disease, and the role of fine-needle aspiration cytology (FNAC) and core biopsy (CB) in pre-operative evaluation remains uncertain. Our aim was to determine the diagnostic accuracy of FNAC and CB in the management of these lesions. The results of FNAC and CB in 54 women (age range 36–72 years) with a definitive diagnosis of RS or CSL at excision biopsy between January 1997 and January 2002 were reviewed. FNAC in 37 patients was inadequate in 15 (41%). Sixteen patients were classified as C2 (43%), three as C3 (8%), one as C4 (3%) and two as C5 (5%). CB in 37 patients was graded as B1 in four patients (11%), B2 in 27 (73%), B3 in four (11%) and B4 in two (5%). Four cases of ductal carcinoma *in situ* and three of invasive carcinoma were identified following excision biopsy. None was diagnosed pre-operatively by CB. One invasive carcinoma was diagnosed on FNAC. One patient was classified as B4 on CB. Another patient had a false positive result on FNAC. Only 11 out of 37 women (30%) had a positive diagnosis of RS or CSL on pre-operative CB. A further seven women (19%) had CB results suggestive of RS or CSL.

Pre-operative FNAC and CB are insufficient to accurately diagnose significant pathology associated with RS or CSL. Excision biopsy remains essential.

56 Decubitus position for horizontal approach mammotome: is it possible?

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The objective of this poster is to assess the feasibility of using the decubitus position for horizontal arm mammotome biopsy on upright stereotactic equipment. Illustrated examples of the preferred approach for lesions in each of the four quadrants of the breast shall be included.

57 Evaluation of the need for magnification views in the assessment of calcification in computerised mammography

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Magnification views are routinely used for the assessment of breast calcification. Computerised radiography may eliminate the need for magnification views as such images can be magnified on the computer console. This study evaluates the additional information gained from computerised magnification views in the mammographic workup of 100 women presenting with calcification on screening or follow-up mammography. The ability of our Fuji computerised radiography with General Electric's PACS equipment to display standard mammographic test tools (TORMAS and TORMAM) is also evaluated.

58 Welcome to North Wales breast screening

W Thomas
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The content of this poster initially depicts the working practice and location of our department. As this is the first poster from Breast Test Wales, we felt it was important to include some of our background history. The second part of the poster presents the results of recent surveys undertaken at Breast Test Wales. The first survey shows the effect of increasing the kV to 34 to perform magnification views in mammography. The second survey concerns the T/R rate during assessment clinics, with some additional information on the general T/R rate.

59 To mag or not mag: that was the question?

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Aims: (1) To compare digital magnification views with zoomed images on the Senographe 2000D workstation. (2) To compare the number of digital magnification views to analogue magnification over a period of 1 year.

Method: Over a 1-year period an assessment was made as to whether a radiologist could determine a difference between zoomed images and magnified digital images. In addition, a comparison was made with the number of requests for magnification

views in the first year of full field digital mammography (FFDM) compared with the same period prior to installation of FFDM.

Results: Radiologists could not see a difference when comparing zoomed or magnified images. It was noted that in the 1-year period following FFDM installation requests for magnification views had fallen by 80%.

Conclusion: We conclude that the introduction of digital mammography has reduced patient dose, where additional magnified views would have been required. We believe this has benefited the service by reducing patient anxiety and waiting list through reduced mammographic recalls for additional views.

60 An evaluation of the current role of radiographer film readers in breast screening

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Literature suggests that both the government and professional bodies are supportive of role development and changing of professional boundaries, but is this representative of current clinical practice?

All 97 mainland UK National Health Service Breast Screening Programme (NHSBSP) centres were surveyed. Postal questionnaires were sent to both radiographer film readers and departmental superintendent radiographers centring on practical, clinical and managerial issues concerning the current practice and implementation of extended roles. An overall response rate of 79% was achieved. Of radiographers working in breast screening, 10% are trained in image interpretation and reporting in mammography. Only 43% of these read annually a minimum of 5,000 mammograms – the quality guidelines for radiologists. Many barriers inhibiting the utilisation of radiographer film readers were identified:

1. Resource constraints, both human and financial
2. Time constraints
3. Quality assurance issues
4. National structure.

This study demonstrated under-utilisation of radiographer film readers in the UK NHSBSP, raising the issue of 'Is training radiographers to film read an efficient and effective use of scarce health care resources?'

Further research into this contentious issue is necessary to fully evaluate and ensure effective use of clinical skills; better service to the patient; and efficient use of health care resources is undertaken.

61 Changes in reporting practices with time when radiographers and radiologists double read screening mammograms

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We have previously presented our experience of double reading screening mammograms by radiologists and trained radiographers. Our initial data showed that radiographers more readily detect calcification and smaller cancers compared to radiologists, who more readily detected larger cancers and higher grade tumours. To evaluate whether these differences have persisted with time, we have reviewed the last 4 years' data and compared the first 30,000 screening mammograms double read by radiographer and radiologist to the subsequent 30,000. The radiographers persistently detect malignant calcification more successfully than the radiologists. Differences in all other parameters have reduced. The group of film readers in our unit have not gravitated to a common mid point with time but have changed with time and reduced the differences in detection of all radiographic abnormalities except for calcification. We will present these data in detail and discuss possible reasons for persistent differences between the two groups of readers in detection of malignant calcification.

62 Are there demographic differences in film reading skill?

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Since 1991, the majority of UK breast screening radiologists have annually taken part in the Personal Performance in Mammographic Screening (PERFORMS) self-assessment scheme. In addition to reporting a set of difficult mammographic cases, they have also completed a questionnaire where they indicated their normal screening practices (e.g. number of cases read per week, mammographic views used and the time of day they usually read screening cases) and demographic details (e.g. age, gender and experience).

The purpose of this study was to determine whether there were any correlations between these questionnaire data and the various performance measures provided by the self-assessment film sets. Additionally, any change in response to the

questionnaire over time was examined. All data presented are anonymous. There were no significant differences for gender, but significant correlations were found for some of the questionnaire responses and performance. For example, experience and the number of cases read per week were positively correlated with some performance measures.

In conclusion, different screening practices and some demographic differences can have an effect on an individual's performance in interpreting a self-assessment film set. This finding may also be applicable to actual breast screening performance.

63 The establishment of an assessment method for radiographers to undertake mammographic image interpretation and reporting

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The radiographic report is a communication channel for the reporter to the referring clinician. It is sometimes crucial in major decisions and may have legal significance [1]. The problem for the educationalist when assessing radiographers to undertake mammographic image reporting is that there is no performance standard [2]. This research was undertaken to establish an assessment method for mammographic image interpretation and reporting that was valid, reliable and fair [3].

Objectives: To develop an assessment form for mammographic reading/reporting. To determine the number of cases for reporting in the allocated assessment time. To propose the mark weighting for each section of the assessment form. To establish a pass mark.

Results: The agreed format for the assessment form was as follows: four sections headed clinical details, radiological observations, appropriate response and conclusion (including recommendations if appropriate). Ten cases were to be undertaken per hourly assessment. Twenty marks were allocated to each case, the observation section holding the greatest weighting. The pass mark required 100 marks from the available 200 – a fail for four cases being misinterpreted.

Modification following re-evaluation after implementation: The assessment time was increased. One hundred marks plus 70% agreement in appropriate response section was required for a pass.

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64 Assessing performance of screen readers in the National Health Service Breast Screening Programme (NHSBSP)

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Rapid expansion of the National Health Service Breast Screening Programme (NHSBSP) will result in many new readers undertaking the task of screen reading. A timely method for assessing performance (sensitivity and specificity), and preferably one that facilitates a steep learning curve, will be required. Since 1995, 90% of films have been double read at this unit. A manual record is kept of cancers detected through double reading and subsequent 3rd reader arbitration. The number of cases read and individuals' recall rates, when acting as the 1st reader, were obtained by running an annual co-writer report. A total of 150,344 women were screened between April 1995 and March 2001, resulting in the detection of 880 cancers. Sixty-six (7.5%) were detected following arbitration. There was variation both in recall to assessment rates and in the number of cases incorrectly returned to routine recall between readers. Prompt feedback of 'missed' cases allowed readers to modify their recall thresholds for particular mammographic abnormalities. If the cases had been single read the reader would have remained unaware of the 'miss' until the woman presented symptomatically with an interval cancer or the cancer was detected at the next screening round. It is recommended that the National Screening Committee review the policy of single versus double reading in the NHSBSP.

65 Analysis of results of the X-ray mammography in diagnostics on breast cancer

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We examined 2,134 women; breast cancer was detected in 216. One hundred and forty cases were subjected to an in-depth analysis: stage I was detected in 25 patients, stage II in 60, stage III in 46 and stage IV in 9. In 5% of the cases, tumours were inpalpable and could be detected by X-ray only. In 8.7 of the cases, the multicentric nature of tumour growth was established. In 62% tumours were of mixed histological structure. Breast cancer recognition provided accurate diagno-

sis in 98%. Good diagnostic results are possible under special conditions in a mammology unit where a röntgenologist works in close contact with surgeons and morphologists. We perform all stages of diagnosis beginning with the clinical examination proceeding to special methods requiring X-ray control (paracentesis, ductography, pneumocystography, pre-operative marking of the breast and marking of the remote sectors of the breast).

66 Is it safe to allow general practitioners open access to breast imaging?

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Many departments in the UK do not allow general practitioners open access for breast imaging. Royal College of Radiologists guidelines [1] published in 1999 recommend that direct referral of women by general practitioners for breast imaging should be controlled so that women with conditions requiring referral to a breast surgeon [2] are not inappropriately managed. To avoid overwhelming the already busy symptomatic breast clinics in Leeds, it was decided that direct access for breast imaging should continue but be audited.

Between May 2000 and April 2001, 491 patients were referred with a variety of symptoms, including 173 women with mastalgia and 130 women with a palpable lump. If imaging was normal, then the report advised referral to the breast clinic if the palpable abnormality persisted. Women with a mammographic or ultrasound abnormality requiring biopsy were recalled by the imaging department and 22 women underwent needle biopsy. All attended the next breast clinic for clinical examination and discussion of their results. Three cancers were diagnosed but none presented with a palpable lump. Open access for breast imaging is safe if controlled.

References

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67 A 10-year review of lymphoma detected by breast screening

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Breast cancer and non-Hodgkin's lymphoma are the commonest and 7th commonest malignancies in Australian women, with lifetime incidences of 1 in 11 and 1 in 98. Lymphoma of the breast accounts for 0.5% of all lymphomas. BreastScreen WA records from 1990 to 2000 were searched for lymphoma. During this time, 450,421 women were screened and 2,314 cases of malignancy detected. Eight cases were detected. Patients' ages ranged from 52 to 84. Two were symptomatic, with tiredness and inguinal lymphadenopathy respectively. The abnormality was axillary lymphadenopathy in four cases, intramammary masses in three patients, and both in one case. Intramammary masses were investigated as for any indeterminate lesion. Nodes exceeding 2 cm without a fatty centre were seen in three cases. In the other two cases they were less than 2 cm long but had enlarged. The possibility of lymphoma was considered before biopsy in three cases, all axillary lymphadenopathy. Diagnosis was confirmed by open biopsy in seven cases. There were seven cases of low grade non-Hodgkin's lymphoma, and one case of intermediate grade. Lymphoma can be detected on screening mammograms as an intramammary mass or as axillary lymphadenopathy.

68 An audit of benign biopsies performed in patients assessed by the Leeds/Wakefield Breast Screening Unit

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This audit was performed in order to clarify any relationship between an increase in benign biopsies and use of the B3 core biopsy category. Women who had been screened between 1 April 1999 and 31 March 2000 by Leeds/Wakefield Breast Screening Service and who had undergone a surgical biopsy for a lesion subsequently proving benign were identified and all pre-operative investigations reviewed. Thirty-six women had undergone a surgical excision biopsy for a benign lesion and 22 of these (61%) had had a B3 biopsy categorisation. Twelve of these reflected a pathological suggestion of radial scar but there were 10 others and a wide variety of lesions were represented. Two papillary lesions, two fibro-epithelial lesions, two difficult intraductal epithelial proliferations and two biopsies containing pools of stromal mucin were found, as was one case of atypical lobular hyperplasia and one unusual vascular lesion.

We suggest there may be a relationship between the histological uncertainty, which may arise as a consequence of the limited sampling of core biopsy and a rise in the number of benign biopsies performed. It is possible that newer vacuum assisted techniques such as the mammotome may prove helpful in avoiding the need for open biopsy in some of these patients.

69 Diagnosis of dermal calcification

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This presentation will illustrate how the combination of established mammographic techniques and the alternative use of a biopsy attachment helped us to develop a technique that allows differential radiological diagnosis between dermal calcification and other calcification within breast tissue.

The accurate radiological diagnosis of dermal calcification has many advantages: the possible prevention of unnecessary biopsy procedures; results can be given on the first visit; reduction of patient time in department; and reduction of patient anxiety induced by both biopsy and the wait for results.

Dermal calcifications typically have lucent centres and maintain their positional relationships regardless of radiographic view (the tattoo sign). It is the maintenance of these positional relationships that enables a possible diagnosis of dermal calcification.

Confirmation of this diagnosis can be made using the Siemens Mammomat 3000 and biopsy attachment with shadow cross. It is possible to accurately locate and subsequently skin mark the calcification. Tangential views are taken following the skin marking. If the calcifications are found to be within 3 mm of the skin marker the diagnosis of dermal calcifications can be made.

70 Phylloides tumours: review of 42 cases

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Aim: This is a review of 42 cases of phylloides tumours seen in the two breast units over a 5-year period (1996–2001). The importance of triple assessment and particularly correlation between radiology and cytology is shown.

Methods and results: All patients with confirmed histology report of phylloides tumours were included in the study. The age range of patients was 23–76. One patient had bilateral phylloides tumour. Twenty-four patients had an R3 score and 36 patients had a U3 score. Thirty-seven patients had C3 score. Nineteen patients had core biopsy, which confirmed phylloides tumour. Four patients had B1 core and 14 patients preferred excision to core biopsy. Thirty-six patients had benign phylloides tumour and six patients had malignant phylloides.

Discussion: Clinically, most of the benign phylloides were diagnosed as fibro-adenomas. However, as can be seen in the data above, many phylloides tumours do have a slightly atypical appearance either on radiology or cytology, or both. The multidisciplinary team reviewed all these patients before a decision for surgery was made and all histology was reviewed.

Conclusion: Triple assessment and multidisciplinary team approach is essential for all atypical radiology or cytology scores.

Late submission

2 Hormone replacement therapy (HRT): indications and side-effects

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Hormone replacement therapy (HRT) has been prescribed to relieve typical oestrogen deficiency symptoms, conserve postmenopausal bone and thereby reduce the risk of osteoporotic fracture, and also to reduce the risk of certain arterial diseases such as ischaemic heart disease (IHD).

Numerous placebo-controlled studies have confirmed that oestrogens reduce the frequency and severity of flushes and sweats, and also improve vaginal dryness. Although not consistent, some data report an improvement in psychological symptoms such as poor memory and concentration. At appropriate daily dose, oestrogens reduce postmenopausal bone loss in both spine and hip; data on fracture efficacy from controlled studies at both of these sites are lacking, but observational data report reductions in fracture risk.

The effects of HRT in women with risk factors for IHD are controversial, with some studies reporting benefits but others not. The majority of the observational data in apparently fit and healthy younger women report an approximate 50% reduction in IHD with use of HRT.

The major long-term concern of use of HRT is risk of breast cancer. There is an approximate threefold excess risk of venous thrombosis with all forms of therapy and an approximate 60% excess risk of gallstones with oral therapy. Other side effects tend to be short-lived and include breast tenderness (due to the oestrogen) and a PMT-like complex (due to the progestogen). Numerous studies report no significant effect on weight, systolic or diastolic blood pressure.