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Initial experience with MicroPure™, a new ultrasound image processing function to improve calcification visualisation

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Introduction Mammographic calcification may be the only sign of breast malignancy often requiring diagnostic biopsy. If visible, this calcification may be biopsied using ultrasound guidance or using X-ray guidance if not. Ultrasound biopsy is quicker, cheaper and more comfortable for the patient. Any technique that improves ultrasound calcification visualisation is desirable. MicroPure™ (Toshiba Medical Systems Corporation, Otawara, Japan) is a new ultrasound processing technology designed to achieve this.
Methods We prospectively audited our experience of calcification detection with B-mode ultrasound and MicroPure™ between April and July 2010. Twenty-five women presenting with a dominant mammographic abnormality of calcification were studied. Targeted imaging with both techniques was performed with a Toshiba Aplio™ XG ultrasound machine using a 12 MHz linear probe. Technical support to optimise imaging was provided during our audit by Toshiba. We recorded ultrasound visibility with these two techniques and histological diagnosis.
Results Of 24 screening and one symptomatic woman examined, 11 (44%) were diagnosed with breast malignancy (six invasive cancers, four DCIS, one LCIS), and 14 (56%) were benign. Overall four (16%) (three malignant and one benign) calcifications were visualised by ultrasound. All were detectable using both B-mode and MicroPure™. Subjectively all four were felt to be more conspicuous using B-mode than MicroPure™.
Conclusions Our initial experience has demonstrated MicroPure™ to be no better at detecting benign or malignant mammographic calcification than B-mode ultrasound. MicroPure™ would only be useful if it detects calcifications that are not visualised with B-mode ultrasound therefore reducing X-ray-guided biopsies.

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A retrospective review of triple-negative breast cancer cases: are there common features in the clinical presentation, imaging and risk factors?

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Introduction Triple-negative breast cancer (TNBC) cases comprise approximately 15% of newly diagnosed breast cancers and are associated with poor prognosis and limited treatment options. In this retrospective study from South Wales, 81 patients with breast cancer found to be ER, PR and HER2 negative were reviewed to determine whether there are common imaging and pathological findings.
Methods Patients identified from pathological databases at two hospitals included symptomatic and screening cases. Clinical records were reviewed to determine age at diagnosis, family history and clinical findings; pathological reports to identify size, grade, type and nodal status; and imaging studies to determine breast density, lesion type, classification and size.
Results Eighty per cent of patients were aged over 50 years (range 50 to 89 years). Nineteen per cent reported a family history. Eighty-nine per cent were grade 3 tumours, 89% were ductal type of which 30% had associated DCIS. The majority were large tumours (78% over 20 mm). Fifty-two per cent were node positive (20% had more than four nodes positive). Thirty-nine per cent had associated vascular invasion. Calcification was a dominant mammographic feature (37%), 28% had well-defined masses.
Conclusions Previous studies have found well-defined masses to be a dominant imaging feature but this study has found malignant calcification to be more common. The tumours were mainly large and frequently associated with vascular invasion, possibly contributing to the poor prognosis despite being node negative in nearly one-half of the cases. There appears to be an association with family history and to be common in the over 50s, contrary to current thinking. A national prospectively collected database TNBC could aid understanding of this group.

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Is digital better?

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Introduction During the changeover from analogue to digital screening in the UK, reassurance is needed to confirm that the outcomes with digital are equal to or better than analogue screening.
Methods Warwickshire, Solihull & Coventry Breast Screening Service commenced the phased conversion to digital screening in 2005, with a single digital machine on one of three mobiles. This retrospective study compares the screening outcomes of 138,173 women aged between 49 and 70 years screened on analogue or digital imaging between April 2005 and March 2009 inclusive. Approximately one-third of these were screened using digital, the remainder on analogue.
Results The results show no difference in the rates of screen-detected cancer in prevalent or incident groups between analogue and digital, and rates were stable with time. Similar proportions of invasive and non-invasive cancers were detected in both groups and tumour size was not significantly different. No significant increase in cancer detection in younger compared with older women was seen in the digital group, and digital did not diagnose a higher proportion of lobular cancers. No difference in interval cancer rates between the two methods of screening was seen. On radiological subclassification of interval cancers into normal/benign, uncertain and suspicious, significantly fewer interval cancers were classified as uncertain in the digital than the analogue screening group. See Table 1.

Table 1 (abstract P41)

	Analogue		Digital	
	n	**% (95% CI)**	***n***	**% (95% CI)**
Normal/benign	97	73.5% (66.0 to 81.0%)	72	85.7% (7.02 to 93.2%)
Uncertain	20	15.2% (9.0 to 21.3%)	3	3.6% (–0.4 to 7.5%)
Suspicious	15	11.4% (5.9 to 16.8%)	9	10.7% (4.1 to 17.3%)

Conclusions These results are reassuring that digital diagnoses similar cancers to analogue screening, and suggest that digital may allow more definitive interval cancer classification.

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Variability in film reader estimates of breast density in the PERFORMS scheme

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Introduction All UK screening personnel are invited to take part annually in the PERFORMS self-assessment scheme where they make several judgements about series of challenging recent screening cases. As part of this process they assess the density of each case. Density is a factor known to be associated with a greater risk of developing breast cancer and thus accurate density judgements may well presage the facility to proffer improved follow-up for individual women. The present study examines the degree of variability amongst film reader estimates of breast density on a large number of cases.
Methods Data were examined from the most recent 2 years of the PERFORMS scheme where breast density estimates were made for each case examined using a three-point rating scale of fatty, mixed density, and dense. These data comprised information from 444 individuals (mainly consultant radiologists, advanced practitioners and breast physicians) who had all examined the same 240 difficult cases.
Results The inter-rater reliability, corrected for chance agreements, was assessed using kappa. Overall, the degree of agreement across cases on breast density category was significantly greater than no agreement (P <0.0001). However, only a moderate degree of inter-rater reliability was

exhibited, κ = 0.470. There were significant differences between the levels of agreement amongst the ratings of the radiologists, advanced practitioners and others (all P <0.05).
Conclusions The low agreement rates between participants for density ratings were surprising. That there were differences between the occupational groupings may reflect breast screening experience.

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Seeding of tumour cells following breast biopsy: a literature review

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Introduction This literature review examines evidence relating to needle biopsy of the breast and the potential for later tumour cell migration into adjacent tissues.
Methods A literature search was undertaken, using Medline, Embase and the Cochrane Library.
Results The results were analysed by the following: (1) Histological evidence of spread (seven papers addressing this were scrutinised; number of patients reviewed was 1,046). Tumour cell displacement occurs in about one-third of patients, the majority do not survive displacement. Vacuum biopsy techniques may reduce seeding potential. (2) Clinical evidence of recurrent disease (nine papers were scrutinised; number of patients reviewed was 1,575). Sporadic reports of tumour recurrence suspected to be a consequence of a biopsy procedure are described. Care to excise the site of needle biopsy is advised by some, especially if outside the radiotherapy field. (3) Likelihood of seeding dependent upon tumour type (three papers were scrutinised; number of patients reviewed was 258). There is limited evidence to suggest lobular carcinoma is less likely to seed than ductal.
Conclusions There is histological evidence of seeding of tumour cells from the primary neoplastic site into adjacent breast tissue, following biopsy. However, clinical recurrence at the site of a needle biopsy is uncommon. This event may be lessened by use of vacuum biopsy techniques. The site of needle biopsy should be considered at the time of surgery.

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How can the prevalent round recall rate be reduced?

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Introduction The prevalent round recall rate is higher than the incident recall rate. Implementation of age extension will lead to two prevalent rounds and with this increased clinical and financial pressure on screening units. Any processes that help reduce the recall rate will be of benefit to screening units.
Methods Retrospective data were collected from April 2008 to March 2009 of prevalent round ladies recalled to assessment clinics. The data recorded included reason for recall, imaging findings and needle test results.
Results A total of 7,627 women were invited for screening in April 2008 to March 2009, of which 5,341 attended. Four hundred and eighty-one ladies were recalled to assessment; 451/481 of the packets available were reviewed. Forty cancers were identified in 39 patients. All cases of malignancy were coded as RU, RS or RM at the time of film reading. Thirty-two patients were recalled for both sides, four patients recalled for two lesions within the same breast. Nineteen patients were clinical recalls (BA). All solitary RB masses thought to be benign at the time of film reading proved to be benign (91/215 masses). Ten cases recalled for bilateral RB masses were benign. Thirty-six out of 140 asymmetries thought to be benign at the time of film reading were benign.
Conclusions The recall rate may be reduced in the prevalent round by not recalling solitary RB masses, bilateral RB masses, and asymmetry that appears physiological/benign on two views. In this unit this would have reduced the recall rate without adversely affecting the cancer detection rate.

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Educational abstract

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Breast histoscanning: the development of a novel technique to improve tissue characterization during breast ultrasound

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Introduction Imaging alone cannot reliably distinguish benign/malignant breast disease or assess the extent of cancer. This study assesses the feasibility of using additional information obtained at US (BHS) to aid diagnosis and preoperative assessment.
Methods 3D US scans at 8 MHz, 12 MHz, 15 MHz were obtained of breast tissue in normal volunteers in two planes and with/without harmonics. Five volumes of sagittal scans at 8 MHz from three individuals were used to identify normal characteristics and define the baseline. The 3D volume was divided into voxels (0.1 x 2 x 1.5 mm) and raw data from each voxel were analysed by applying linear and nonlinear classifiers to assess 29 statistical characteristics (BHS). The training dataset contained 300,000 voxels. After training, the classifier's output showed 3% error on both normal and abnormal tissue. The algorithm was tested on 32 further volumes representing 6,000,000 voxels of normal and abnormal tissue from 20 individuals. Abnormal tissue included various biopsy-proven lesions: malignancy (six), papilloma (one), hamartoma (one), fibroadenoma (two), cyst (two), fibrosis (one). Subclassifiers were developed to distinguish between cancer and benign voxels.
Results In 17 normal testing volumes, 3% of isolated voxels were classified as abnormal. In 15 abnormal testing volumes, the subclassifiers differentiated between malignant and benign tissue. BHS in benign tissue showed <1% abnormal voxels in cyst, hamartoma, papilloma and benign fibrosis. The fibroadenomas differed showing <5% and <24% abnormal voxels. Abnormal voxels in cancers increased with the volume of cancer at pathology.
Conclusions Histoscanning reliably discriminated normal from abnormal tissue and could distinguish between benign and malignant lesions.

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Single voxel proton magnetic resonance spectroscopy of breast cancer at 3T

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Introduction *In vivo* detectability of a signal (tCho) from choline containing molecules at ~3.2 ppm by MR spectroscopy (MRS) can be useful as a biomarker for malignancy. tCho has also been observed in benign, normal, and lactating breast, therefore quantitation is vital. The aim is to assess whether tCho detectability can differentiate between benign and malignant breast disease and to implement internal water-referenced choline quantitation at 3T.
Methods Women with histologically confirmed breast cancer or suspicious features were identified either at MDT or following referral for clinical breast MRI and recruited following informed consent. Studies were performed on 3T Philips Achieva (the Netherlands). Contrast-enhanced MRI localised the region for point-resolved spectroscopy (PRESS) evaluation. Spectral processing was performed with jMRUI. The choline concentration was determined using the unsuppressed intravoxel water resonance as a reference. tCho detectability and choline concentration were correlated with known pathological information. Results were analysed by JKPB.
Results Nine participants (age range, 38 to 73 years) were successfully examined. tCho was detected at ~3.2 ppm in four of nine lesions (lesion size, 0.8 to 7.0 cm; mean, 3.0 cm), providing a sensitivity and specificity of 67% and 100%, respectively. The two quantitative values of 2.13 and 5.59 mmol/kg are consistent with previously reported findings.
Conclusions MRS is a non-invasive and non-ionising means of analysing lesion metabolism as an adjunct to clinical MRI. Whilst potentially useful for differentiating between benign and malignant breast diseases, implementation is challenging. Using clinical 3T systems, internal water referencing can successfully quantify choline in patients with breast cancer.