Effect of parenchymal pattern in women with dense breasts, variation with age and impact on screening outcomes – observations from a UK screening programme.

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Background:

- Women with denser breasts are more likely to develop breast cancer 1,2.
- Parenchymal pattern (PP) also affects cancer risk - women with dense, nodular breasts have highest risk of cancer diagnosis 4,5.

Study Aims:

1. To demonstrate the distribution of PP in a regional screening population
2. To determine if the ratio of smooth to nodular PP in women with dense breasts varies with age in a screening population.
3. To identify if the likelihood of recall to assessment, biopsy and cancer diagnosis is affected by PP.

Materials and methods:

- Data Collection:
  - Retrospective, fully anonymised study
  - Mammograms acquired on Hologic Selenia and data autowarded via VolparaAnalytics automated breast density software.
  - Individuals with automated breast density data available and with Volpara Grade d (edition 5) (Vgd) breast density were identified from screening population April ‘13 - March ’15.
  - Women with implants or prior mastectomy were excluded.
  - Controls: Randomly selected cases of non-assessed women age 50, 55, 60, 65 and 69-71 (n=500, 100 per age group.)
  - Cases: All women recalled to assessment (n=280).
  - Data on screening outcome, assessment, biopsy and tissue diagnosis was collected.

- Image Interpretation:
  - 10 Readers - 4 consultants, 3 registrars and 3 mammographers.
  - Readers asked to grade PP on all controls and cases on a 5 point scale from (1) very smooth to (5) very nodular.
  - PP expressed as smooth (grade 1,2), mixed (grade 3), nodular (grade 4, 5).

- Statistical Analysis:
  - Nodularity scores for all cases from 10 readers were recorded and reader agreement for controls was assessed by Intraclass Correlation Coefficient
  - Variation with age
    - The proportions of women in categories smooth, mixed and nodular in the control group was compared between age groups
  - Variation with screening outcome
    - The proportions of women recalled, biopsy performed and cancers was compared with controls
    - Variation was using Pearson’s Chi squared test.

Results:

- Breast Density and Age:
  - A total of 40,760 women of all breast densities identified.
  - 4,331 (10.6%) had the highest breast density (Vgd).

- Parenchymal Pattern and Age:
  - The distribution of parenchymal pattern did not vary significantly with age (p = 0.147) (Fig 1).
  - The inter-rater reliability for scoring PP was good (ICC = 0.6302).

- Assessment and Parenchymal Pattern:
  - The ratio of parenchymal pattern did not vary significantly with age (p = 0.657) in women called back to assessment (Fig 2) or subject to biopsy (p = 0.580) (Fig 3).

Discussion:

- Readers are able to grade nodularity with good inter-observer agreement
- Approximately one third of women fall into each of the categories of smooth, mixed and nodular parenchymal pattern.
- This ratio is the same at all ages in our control groups. Wolf originally noted that the majority of cases with a nodular PP was seen in younger, pre-menopausal women[4], but we have shown that this pattern persists in women with the densest breasts in women of all ages.
- The ratio of smooth, mixed and nodular density is similar in assessed women and those who undergo biopsy, suggesting that PP does not affect likelihood of recall or biopsy.
- A greater proportion of patients with nodular breast density were found to have a cancer diagnosis than those with smooth or mixed PP.

Conclusion:

The nodularity pattern in women with dense breasts varies from smooth to nodular. The ratios are similar at all ages and in women called to assessment and subject to biopsy.

18/34 cancers diagnosed in our population of women with dense breasts occurred in women with nodular parenchymal pattern.

As automated methods of parenchymal pattern analysis develop, targeting this population with a more individualised screening approach may maximize the cost-effectively of more broadly applied supplemental screening in women with dense breasts.