Abstract:

Purpose: Breast density on mammograms has become a topic of increasing public awareness. A dense mammogram can obscure a cancer, and raises uncertainty about the effectiveness of mammograms in women who have mammographically dense breasts. This topic has become the focus of legislative activity in many states. To determine if breast density is a risk factor for breast cancer, we evaluated the correlation between mammographic breast density, patient demographics, risk assessment results and Stavros lymph node status.
Procedure: The study was a retrospective review of breast ultrasounds and mammogram screenings already performed at a community hospital. The study was obtained under HIPAA process utilizing anonymized data to protect patient identities. PACs display of ultrasound and mammogram images was performed with medical grade PACs monitors. Totals of 167 ultrasounds and 200 screenings were analyzed. Mammographic breast density, genetics test results, Stavros lymph node character and patient demographics were recorded.
Data: All data was entered and graphed in an Excel Spreadsheet. An SAS program was used to calculate ANOVA and other statistics.

Application of Research: Mammographic breast density should play a larger role in determining the patient's evaluation for breast cancer. Recommendations for patients with increased breast density include additional studies for the early detection of breast cancer. At the forefront of imaging are evolving roles of 3D tomosynthesis, breast ultrasound, and MRI. Our study furthers ultrasound knowledge of the range of normal lymph node type for each category of breast density, which should improve sensitivity and specificity in staging of breast cancer. Risk and genetics testing have become increasingly important.

Introduction/Background:

Breast cancer is the most common cancer among women of all races.

Screening Mammogram:

A medical x-ray imaging test performed for the detection of breast cancer in women with no symptoms. The purpose of screening mammograms is to decrease morbidity and mortality by detecting and treating breast cancer early.

Breast density on mammography is produced by attenuation of the x-ray beam by various tissues of the breast.

•Fibrous and glandular tissues produce greater attenuation of the x-ray and appear white on mammography.

•Fatty tissue will produce less attenuation and appear dark on mammography.

•**Breast cancer** attenuates similar to fibrous/glandular tissue and will appear white. Breast cancer, therefore, can be obscured by fibrous/glandular tissue.

4 Categories of Breast Density:

BI-RADS is an acronym for **B**reast **I**maging-**R**eporting **A**nd **D**ata **S**ystem by the American College of Radiology (ACR) and is a descriptor for breast density. Radiologists utilize 4 categories to describe breast density on mammograms. Category 1 is the least dense whereas Category 4 is the most dense.

Questionnaires:

Gail Model- Breast Cancer Risk Assessment Tool. The first and most commonly used questionnaire by primary care physicians. Historically, this model did not emphasize family history of cancer to assess risk.

Genetics Questionnaire to Assess your Breast Cancer Risk- Includes a series of questions which determine criteria for genetic counseling referral.

Breast Ultrasound:

Breast density has never been correlated with ultrasound of axillary lymph nodes, and this study will help establish associations and expectations of the normal range of variation.

Stavros 2 Zone: Ultrasound description of a benign lymph node where 2 zones of reflectivity are identified (the hypoechoic cortex and a hyperechoic medulla).

Stavros 3 Zone: Ultrasound description of a benign lymph node where 3 zones of reflectivity (hypoechoic cortex, a hyperechoic medulla, and a central zone of isoechoic fatty infiltration).

Methods:

The study was a retrospective review of breast ultrasounds and mammogram screenings already performed at a community hospital. The study was obtained under HIPAA process utilizing anonymized data to protect patient identities. PACs display of ultrasound and mammogram images was performed with medical grade PACs monitors. Totals of 167 ultrasounds and 200 screenings were analyzed. Mammographic breast density, genetics test results, Stavros lymph node character and patient demographics were recorded.

Results/Conclusions:

This study was designed to evaluate relationships between mammographic breast density and breast cancer risk factors, as determined by a modified Gail model and by a genetics referral form. Additionally, breast density was correlated to lymph node zones at breast ultrasound.

- **Breast density** is statistically significant in its association with the patient demographics of age and Body Mass Index.
- **Breast density** is statistically significant in its association with the results of the Gail Risk Model for Life Risk.
- **Breast density** is statistically significant in its association with the results of a positive Genetics Referral Form.
- **Breast density** is borderline statistically significant in its association between two benign sonographic lymph node types.

This study confirms that breast density is an independent risk factor for breast cancer. Breast density should be added to risk models for clinical use. Also, knowledge of breast density and lymph node type may help guide staging.

Discussion:

Breast Density and Age: Breast density decreased with increasing age. This is displayed on the bar graph and box-and-whisker graphs and was true for both screening mammogram and ultrasound data. These were statistically significant: the ANOVA screening mammogram $p = .007$ and $p < .001$ for the ultrasound group.

Breast Density and BMI: Breast density decreased with increasing BMI. This is displayed on the bar graph and box-and-whisker graphs. This was true for both screening mammogram and ultrasound data. These were statistically significant: the ANOVA resulted in $p < .001$ for both the screening mammogram and the ultrasound groups.

Breast Density and Life Risk: Breast density increased with increasing Life Risk. This is displayed on the bar graph and the box-and-whisker graph. This was statistically significant: the ANOVA resulted in $p = .025$. Log-transformation ANOVA was also taken to reduce variance within each group and this was statistically significant at $p = .001$.

Breast Density and Genetics Referral: Breast density increased with positive genetic questionnaire referrals. This is displayed on the bar graph. This was statistically significant: the ANOVA resulted in $p = .030$.

Breast Density and Lymph Node Volume: Breast density decreased with increasing lymph node volume, but this was not a statistically significant trend. The ANOVA resulted in $p= .093$.

Breast Density and Lymph Node Status: Breast density decreased with an increasing proportion of 3 zone lymph nodes. This is displayed on the bar graph. This was a borderline significant value: the ANOVA resulted in $p = .051$.

Applications of Research:

Mammographic breast density should play a larger role in determining the patient's evaluation for breast cancer and adopted into risk/genetics assessment. Recommendations for patients with increased breast density may include additional studies for the early detection of breast cancer. At the forefront of imaging are evolving roles of 3D tomosynthesis, breast ultrasound, and MRI. Our study furthers ultrasound knowledge of the range of normal lymph node type for each category of breast density, which should improve sensitivity and specificity in staging of breast cancer.