

Quantitative assessment of volumetric breast density on mammography: association with breast cancer risk

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PURPOSE: To compare quantitative breast density parameters obtained using an automatic volumetric breast density (VBD) measurement tool between normal controls and breast cancer patients.

MATERIALS AND METHODS: From June 2011 to January 2013, total breast volume (TBV), fibroglandular tissue volume (FGV) and VBD of 28,010 mammograms were analyzed using an automatic breast density measurement software (Volpara™; Volpara imaging 1.5, Matakina, Wellington), which is applied to digital mammograms. Among the total 7252 cases, 198 women had newly diagnosed breast cancers. TBV was defined as the total breast volume in cubic centimeters; FGV as the volume of non-fatty tissue within the whole breast; and VBD as the ratio of the fibroglandular tissue volume to the total breast volume. We compared these three quantitative density parameters between normal controls and breast cancer patients using Student t-test. We also used logistic regression to analyze the association between breast density parameters and breast cancer risk.

RESULTS: The mean age of normal controls (50.1 years) was significantly older than patients with breast cancer (47.7 years) ($p < 0.001$). The mean TBV, FGV and VBD were 492.7 cm³, 68.7 cm³, and 15.7% for cancer patients and 429.6 cm³, 55.7 cm³, and 14.7% for normal controls on CC view, which were significantly different between the two groups ($p < 0.001$ for all three parameters). In addition, the mean TBV, FGV, and VBD on MLO view were 546.9 cm³, 63.6 cm³, and 12.6% for the cancer group and 485.6 cm³, 54.3 cm³, and 12.5% for the control group, which also showed significant differences between the two groups ($p < 0.001$ for all three parameters). On logistic regression analysis, VBD, FGV, and TBV showed significant associations with breast cancer risk and odds ratios were 4.1 for VBD, 1.4 for FGV, and 1.03 for TBV.

CONCLUSION: Our results showed that there were significant differences of quantitative breast density parameters obtained using an automatic measurement software between normal controls and patients with breast cancer. These automatic quantitative parameters could be expected to help stratify breast cancer risk according to breast density.