Preliminary results of objective assessment of mammographic percent density

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Summary

Breast density assessments performed by using the Breast Imaging Reporting and Data System (BI-RADS) have been completely qualitative and the American College of Radiology (ACR) fibroglandular density descriptors are mainly subjective. However, women with increased mammographic density (MD) have an increased risk of developing breast cancer. The purpose of our study was to evaluate an experimental method to quantify MD using a software utility which measures absolutely black areas as zero and absolutely white areas as 100. In grey scale areas, these values range between 0 and 100, depending on the "density" of the area. Digital screening mammograms were directly estimated with this method. We concluded that there is a significant correlation between ACR quartiles and this grey scale percentage method, although several improvements on the original idea are planned.

Key words: Mammographic density; Digital mammography; Breast density assessment.

Introduction

The efficacy of mammographic screening has been established by randomized controlled trials in which absolute mortality reduction has been achieved by the ability of mammography to find ductal carcinoma in-situ and infiltrating cancers of a smaller size and earlier stage than in unscreened control groups [1-4]. Digital mammography has been shown to have at least equivalent diagnostic accuracy to screen-film mammography and it offers some potential advantages over conventional technology [5] as magnification, subtraction of parasite signals, contrast changing, reproductivity and storage.

Breast density assessments performed by using the Breast Imaging Reporting and Data System (BI-RADS) have been completely qualitative [6]. The American College of Radiology (ACR) has also developed the following set of fibroglandular density descriptors that may be used within the text of a mammogram report: "almost entirely fat" (< 25% density), "scattered fibroglandular densities" (25%-50%), "heterogeneously dense" (51%-75%), and "extremely dense" (> 75%) [7], although these estimations are mainly subjective. However, women with mammographic percent density (MPD) > 50% have an approximately three-fold increased risk of developing breast cancer [8].

The purpose of this work was to evaluate an experimental method to quantify MPD utilizing Mac OS X Software.

Material and Methods

A prospective study on a method of calculation of breast mammography density was carried out. Our main purpose was to obtain an objective value of mammographic density for digital mammography and to "avoid" the subjectivity of the ACR classification which is not always reproducible.

The DigitalColor Meter is a Mac OS X utility that measures colors and translates the color values into those used by different color models, such as RGB (red-green-blue). In the RGB color model, the grey scale pictures have the same RGB values. In absolutely black areas all values, expressed as percentage, are zero and in absolutely white areas all values are 100. In grey scale areas the values are between 0 and 100, depending on the «density» of the area.

In digitized mammographies, pointing to the areas of mammography to be measured, and pressing Shift-Command-C, the gray scale values are copied to the clipboard. Reducing the size of mammography and expanding the examined area in a broader surface, a more representative value for the whole breast could be achieved (Figures 1 & 2 magnified).

Digital screening mammograms from 47 patients were directly estimated with the program and compared with clinical impression based on ACR quartiles, blindly estimated by the authors.

Results

Density values in mediolateral oblique mammograms were increased in comparison with craniocaudal projections, due to the major pectoralis muscle. Therefore, to avoid the "whiteness" of the major pectoralis muscle, only craniocaudal projections were estimated.

Furthermore, the black background of mammograms (circumferencially of the breast) lowered the real density value in all mammograms. Hence, the background was changed to grey in an effort to achieve values close to those obtained by clinical estimation. This "trick" did not

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Fig. 1

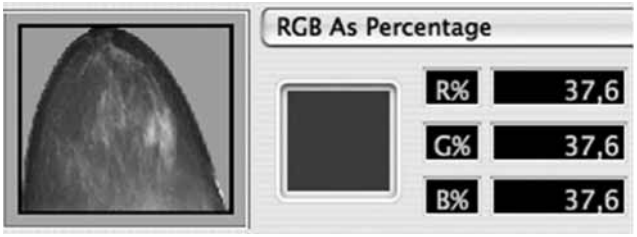

Fig. 2

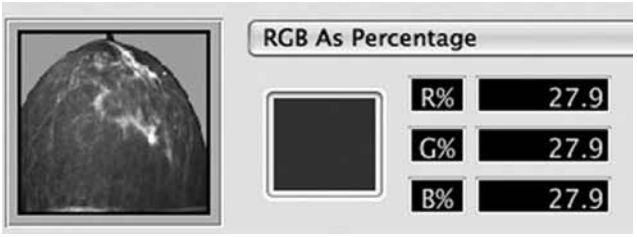

Figure 1. — "Mammographic breast density" estimated as red-green-blue percentage.
Figure 2. — "Mammographic breast density" estimated as red-green-blue percentage.

influence the quality of density estimations and density comparisons among mammograms because the breast itself remained intact and the same scale of grey was used for all mammograms. Equally, with this method, no further calculations were necessary to compare clinical estimations with the program estimations or the use of special tables, and the "automated" percentages corresponded to the clinical impression quartiles of ACR.

Discussion

Despite the fact that a biopsy is to be undertaken for a palpable abnormality, mammography is still important to evaluate the area in question as well as to screen the remaining ipsilateral and contralateral breast tissues for clinically occult cancer.

By definition, mammographic screening involves the performance of the mediolateral oblique and craniocaudal projections. However, due to the square shape of the aperture area examined, it was not possible to avoid the major pectoralis without losing a part of breast tissue in mediolateral oblique projections.

The ACR set of fibroglandular density descriptors is a very useful method of clinical description although some degree of hesitation could arise when such a description belongs to the upper or lower limit of the previous or next category respectively, as in our example of Figure 2. In this case, our method has a degree of descriptive accuracy, although this method could be proposed more as a comparative tool among mammograms than a unique tool for a specific mammogram.

Previous studies have quantified objectively the mammographic (percent) density, correlated it with breast cancer risk and made digitized assessments of mammographic breast density in patients receiving hormonal regimens [9-11].

Taking into account that breast density may actively be related to breast cancer risk, methods of breast densitometry must be accurate, reliable, easy to learn, easy to perform, widely available, quick, cheap and repeatable.

Further validation of accuracy and possibilities of changing shapes in examined areas with similar programs are ongoing investigations at our institutions.

Conclusions

There is a significant correlation between ACR quartiles and this grey scale percentage method, although we plan several improvements on the original idea. Our initial ideal could prove to be an important one in mammography screening because it is based on a cheap, easy to learn and perform, relatively quick, and repeatable method.

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