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Review

What effect does mammographic breast density have on lesion detection in digital mammography?

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Effective detection of breast cancer using mammography is an important public health issue worldwide. Breasts that contain higher levels of fibroglandular compared with fatty tissue increase breast radio-opacity making it more difficult to differentiate between normal and abnormal findings. The higher prevalence of breast cancer amongst women with denser breasts demands the origination of effective solutions to manage this common radiographic appearance. This brief review considers the impact of higher levels of density on cancer detection and the importance of digital technology in possibly reducing the negative effects of increased density.

Introduction

High mammographic breast density (MBD) has been shown to be a significant predictor of breast cancer risk, having been linked with a four- to sixfold increase in lifetime risk.[1–4] Byrne et al.[2] found that more than 18% (66 of 354) of cancerous lesions occurred in women with more than 75% MBD and 44.1% occurred in women with more than 50% MBD. Women with low MBD had a lower rate of breast cancer (3.5 cases per 1000 women) than women with high MBD (11.5 cases per 1000 women).[5] The majority of previously published studies has used breast images that have been acquired using conventional screen-film mammographic systems, which has been the primary imaging technique for the breast since the introduction of screening programmes in the early 1970s, although it has been used for many decades.[6] However, the advent of digital mammography in January 2000[7] has introduced many changes to the screening environment, and today in many countries, including Australia, all screening is carried out in a complete digital environment. Given this shift, it is important to ask whether the evidence compiled using analogue technology is still valid in the digital domain, particularly considering emerging new evidence that the limitations faced by radiologists when examining dense breast tissue may not now hold true.

This review addresses the question of whether radiologists face the same set of challenges when reading digital mammograms as they did when reading screen-film, and whether the association of mammographic breast density and risk has to be reassessed in the light of modern digital technology.

Background

The mammographic appearance of breast tissue varies between women according to the differences in breast tissue composition and their x-ray attenuation coefficient.[8]

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Basically, the breast consists of two types of tissue, fat and fibroglandular, which are represented by light and dark areas on a mammogram. MBD is a term used to define the portion of a standard mammographic view that comprises fibroglandular tissue. Examples of breasts with different mammographic densities are shown in Fig 1. Changes in MBD are associated with a variety of factors including age, heritability, use of hormone-replacement therapy, parity, and body mass index. The association of each of these factors with MBD has been reviewed previously.[3,9,10]

The first study to show a link between high MBD and breast cancer risk was reported in 1976, when Wolfe qualitatively classified mammographic images into glandular density patterns, and showed an association with breast cancer risk.[11,12] Since that time, a large number of studies have shown that increased MBD is associated with higher breast cancer risk, and this is consistent when MBD is classified using qualitative[5,13,14] or quantitative measures.[1,15–20]

One of the reasons behind this association has been related to the effect of the MBD masking the lesion, obscuring visibility, and therefore, reducing the radiologist's ability to detect the lesion. Various studies have shown that the efficacy of mammographic imaging is reduced when the images have high MBD, which will be reviewed in the following sections.

Assessment methods for MBD

Many breast density measurement methods have been introduced, however, some are subjective and qualitative, and others are quantitative measures. This review will cite the most common breast density measurements.

Subjective methods include Wolfe's grading, Tabar, Breast Imaging Reporting and Data System (BIRADS), and visual estimation. Wolfe's grading includes four breast

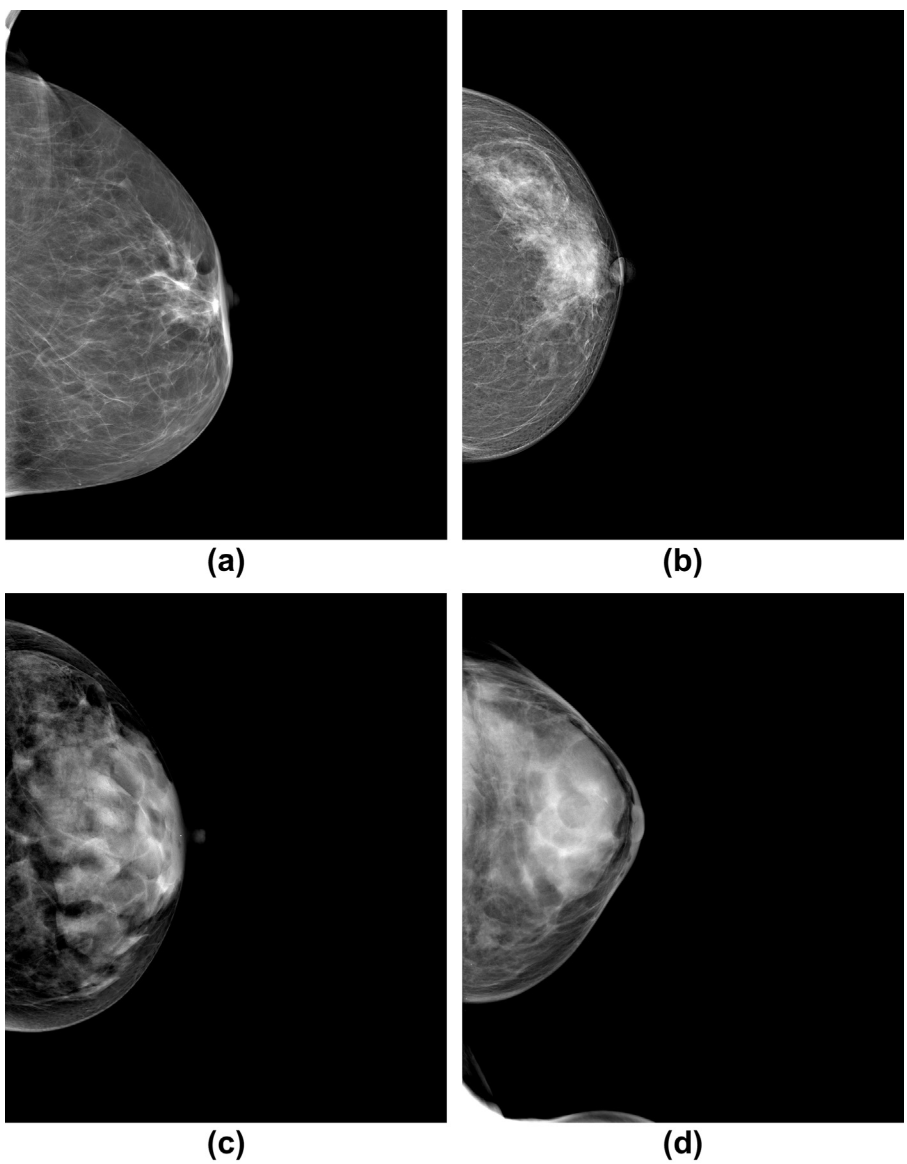

Figure 1 Variation in breast density. (a) Density < 25%; (b) density 25–50%; (c) density 51–75%; and (d) density >75%.