Soft Copy Digital Mammography

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Screen-film mammography (SFM) has been the standard method used for breast cancer screening and making a clinical diagnosis. It is a valuable modality for the detection and differentiation of breast calcifications. The advantages are the high spatital resolution, the convinient display, and inexpensiveness. However, it has some inherent limitations such as its low detective quantum efficiency and the difficulty of post-processing after obtaining an image.

Digital mammography (DM) has the potential to overcome the inherent limitations of SFM. DM systems directly qualify x-ray photons and decouple the process of x-ray photon detection from the image display. The digital images can be processed by a computer and displayed in multiple formats. Thus, DM is better than SFM for the detection of mass lesions due to its high contrast resolution.

However, one of the main clinical tasks of digital mammography is the detection and characterization of breast calcifications. When comparing SFM to DM, SFM has an advantage over DM because it has higher spatial resolution then DM and the detailed image features may be more obvious. On the other hand, DM has higher contrast resolution with the ability to adjust the contrast of the mammograms through use of image processing. While it is possible to improve visibility of calcifications through increasing the spatial resolution, spatial resolution is not the sole factor influencing the visibility of lesion. Contrast resolution is also important in some instances for diagnosing calcifications and the other small features in the image through manipulating the contrast resolution.

Several studies have demonstrated that despite the limited spatial resolution, the visibility of calcifications on DM is not significantly different from that on SFM (1–6). In addition, the pixel sizes in the ranges that are studied do not have a strong effect on the radiologists' accuracy for the characterization of calcifications (3). Obenauer et al. reported that the flat-panel DM system was superior to SFM in image quality, detail visibility, image exposure and artifacts (6). They concluded that the better contrast detectability and the ability to do the image processing highly compensated for the limitations in spatial resolution.

However, most previous reports have focused on comparing observer performance with using SFM and hard copy digital mammography (HCDM). The diagnostic accuracy of the hardcopy and softcopy interpretation is likely to be comparable if a high-resolution laser printer and a high quality workstation having high spatial and contrast resolution monitors are used (7). However, once DMs are printed and displayed on laser films, the flexibility of this system is lost. All of the available information cannot be optimally displayed in a single presentation. On the other hand, softcopy digital mammography (SCDM) is flexible, allowing online contrast manipulation with real-time adjustment, roaming and zooming to full resolution. Thus, SCDM may offer improved specificity for the diagnosis of breast lesions, including calcification.

As picture archiving and communication systems (PACS) become more universally available, it is expected that mammography will also be rapidly converted to SCDM. As more and more institutions move towards soft copy reading, it is as valuable to know that an assessment is as accurate as it could be for demonstrating whether that either technique is superior. Observer performance for SCDM must also be compared to that for SFM to determine whether SCDM can completely replace film-based mammography.

The report by Kim et al. (8) in this issue of the Journal is clinically important. This study showed a higher image quality and superior detectability, as well as the better characterization of the microcalcifications on the SCDM than on the SFM. Their results indicated that SCDM (both the review workstation and PACS monitor) provides improved specificity compared with SFM for the diagnosis of breast calcifications. Recent studies have supported their results (1, 9).

Many challenges remain as SFM is converted to SCDM. For SCDM interpretation to become an accepted replacement for SFM interpretation, its accuracy must be clearly

established on the basis of a larger study. The other challenges are the high costs associated with the required digital infrastructure, data storage and transmission, and developing support for this change from the referring clinicians (10).

Despite these challenges, the long-term prospects of a filmless digital environment and soft-copy interpretation seem to be firmly linked to the future success of digital mammography.

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