Digital mammography: opportunities and limitations

Muttarak M

Breast cancer is the most common malignancy among women in developed countries, and the second or third most common malignancy among women in developing countries.[1] Mammography is the most reliable imaging method used to detect early breast carcinoma. Screen-film mammography (SFM) has been shown in multiple randomised controlled trials to reduce the mortality rate of breast cancer by as much as 30%.[2] However, SFM remains an imperfect tool because the sensitivity of most mammography reports is in the 68%–92% range.[3] Cancer occurring in a dense breast is difficult to detect because of the insufficient difference in contrast between normal and malignant breast tissue. The sensitivity of mammography is inversely proportional to breast density. SFM's main limitation lies in the image acquisition. The image obtained from SFM cannot be corrected if it is captured with over- or under-exposure. Repeat examination may then be required, resulting in increased expenditure and radiation dose to patients. Other limitations of SFM include space for film storage, loss and misplacement of films, and image degradation. Digital mammography (DM) was developed to overcome the limitations of SFM. Thus far, the advantages of DM reported include advanced applications, such as computer-aided detection and diagnosis (CAD), contrast-enhanced mammography, tomosynthesis, and telemammography, although the value of these new techniques in clinical practice has yet to be ascertained.[4]

DM was first approved by the USA Food and Drug Administration (FDA) for clinical use in January 2000. However, studies comparing the clinical advantage of DM over SFM are still ongoing. Lewin et al concluded that there is no significant difference in cancer detection between SFM and DM, but DM showed a lower recall rate.[5] In 2005, Pisano et al compared SFM with DM in 42,760 women screened at 33 centres in the USA and Canada. They concluded that the overall diagnostic accuracy of DM and SFM for screening breast cancer is similar, but DM is more accurate in women younger than 50 years of age, women with radiologically dense breasts, and premenopausal or perimenopausal women.[6] The clinical use of DM for diagnostic mammography remains problematic. The studies to date do not support the advantage of DM over SFM when used for diagnostic mammography.[7,8]

DM images can be interpreted from either hard or soft copies. Hard copy interpretation allows relatively easy comparison of current digital with previously-obtained analogue images. However, image manipulation cannot be done on hard copies. Although soft copy interpretation allows radiologists to manipulate images in any way that they want, it is more difficult to make comparisons with analogue images. However, Pisano et al found no significant difference in time taken for interpretation between hard and soft copy displays.[9] DM can be either a computed radiography digital (CR) system or a direct radiography (DR) system. The advantages of the CR system are that it is cheaper than DR and a pre-existing analogue mammographical unit can be converted to a digital unit. The main obstacle to the widespread use of DR is its high cost.

Do we have to convert to DM? For an appropriate pace of conversion, we have to consider the existing equipment, infrastructure, patient capacity, and work flow. For example, if the existing SFM is old, converting to CR is not logical. Replacing it with DR might be a better choice. On the other hand, if the existing SFM is new and still has years of functionality left, a CR conversion is more reasonable. In this issue of the *Singapore Medical Journal*, Ranganathan et al presented their experience on conversion of SFM to DM in Malaysia. Their conversion was done progressively, from CR mammography to DR mammography.[10] A progressive conversion provides technologists and radiologists time to gradually adjust to the new technology. Their patient throughput was increased as a result. There were less reject and repeat films in DM. However, they only performed 200 DR mamammographies and no clinical benefit was noted.

Taken into consideration that breast cancer is the most common cancer among women worldwide, an effective and efficient imaging method is of paramount importance. SFM is a well-established imaging method for the early detection of breast cancer. However, it has inherent limitations in the detection of lesions in dense breasts. DM represents a new technology in the detection of breast cancer. Its advantage over SFM include image acquisition, display, storage, and advance applications such as CAD, contrast-enhanced mammography, tomosynthesis, and telemammography. However, DM has not yet received widespread implementation, because of its high cost and lack of strong proof of its clinical benefit.

Department of Radiology, Chiang Mai University, Chiang Mai 50200, Thailand

Muttarak M, MD
Professor

Correspondence to:
Prof Malai Muttarak
Tel: (66) 53 945 450
Fax: (66) 53 946 136
Email: mmuttara@mail.med.cmu.ac.th

REFERENCES

1. Parkin DM, Muir CS. Cancer incidence in five continents: comparability and quality of data. IARC Sci Publ 1992; 120:45-173.
2. Nyström L, Rutqvist LE, Wall S, et al. Breast cancer screening with mammography: overview of Swedish randomized trials. Lancet 1993; 341:973-8.
3. Yankaskas BC, Schell MJ, Bird RE, Desrochers DA. Reassessment of breast cancers missed during routine screening mammography: a community-based study. Am J Roentgenol 2001; 177:535-41.
4. Parikh J. Digital mammography: current capabilities and obstacles. J Am Coll Radiol 2005; 2:759-67.
5. Lewin JM, D' Orsi CJ, Hendrick RE, et al. Clinical comparison of full-field digital mammogrpahy and screen-film mammography for detection of breast cancer. Am J Roentgenol 2002; 179:671-7.
6. Pisano ED, Gatsonis C, Hendrick E, et al. Diagnostic performance of digital versus film mammogrpahy for breast-cancer screening. N Engl J Med 2005; 353:1773-83.
7. Kim HH, Pisano ED, Cole EB, et al. Comparison of calcification specificity in digital mammogrpahy using soft-copy display versus screen-film mammography. Am J Roentgenol 2006; 187:47-50.
8. Tice JA, Feldman MD. Full-field digital mammography compared with screen-film mammography in the detection of breast cancer: rays of light through DMIST or more fog? Breast Cancer Res Treat [online] 2007, Mar 22. doi: 10.1007/s10549-007-9545-4.
9. Pisano ED, Cole EB, Kistner EO, et al. Interpretation of digital mammograms: comparison of speed and accuracy of soft-copy versus printed-film display. Radiology 2002; 223:483-8.
10. Ranganathan S, Faridah Y, Ng KH. Moving into the digital era: a novel experience with the first full-field digital mammography system in Malaysia. Singapore Med J 2007; 48:804-7.