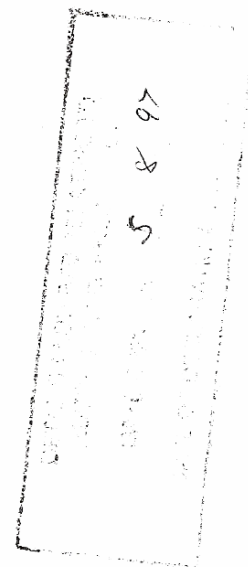


Nonmammographic breast imaging techniques

Sylvia H. Heywang-Köbrunner, MD

Klinikum Großhadern, University of Munich, Munich, FRG

Significant progress in early detection of malignancy has been achieved by the improvement of mammographic technique, the introduction of quality control, the demonstration of benefits from screening, and appropriate application of supplementary methods such as ultrasound, cytology, and stereotaxis. Certain problems in breast imaging, however, are still unsolved. These include early detection and exclusion of malignancy without microcalcifications in mammographically dense tissue (particularly in younger women), the still-limited accuracy of mammographic signs, and the management of diagnostic problems after surgery, radiation therapy, or silicone implants. Therefore, research is needed to further improve diagnostic capabilities. The research can be subdivided into different approaches: 1) further development of the mammographic technique (digital luminescence radiography); 2) evaluation of techniques that image other physical tissue properties (sonography, thermography, transillumination, CT, non-contrast-enhanced MR imaging, biomagnetism, biostereometry, and ductoscopy); 3) investigation of techniques that image metabolic changes (MR spectroscopy, positron-emission tomography) or metabolism-induced differences in perfusion or vascularity (Doppler ultrasound, contrast-enhanced MR imaging); and 4) development of techniques that attempt tissue diagnosis using monoclonal antibodies. Among these techniques, digital luminescence radiography and contrast-enhanced MR imaging are the most developed and the most promising. They are at the threshold of becoming clinically important. Doppler ultrasound could be useful for certain indications. Whereas MR spectroscopy, positron-emission tomography, the search for appropriate antibodies, and possibly transillumination, ductoscopy, and biomagnetism offer interesting new aspects for research, the value of CT, thermography, and biostereometry is not yet established.



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Digital luminescence radiography

Digital luminescence radiography (DLR) images the same physical tissue properties as film-screen mammography. The major advantages of DLR concern the wide dynamic density range of the phosphor plates, their linear gradient curve within wide exposure ranges, and the possibility of postprocessing (windowing, filtering, and so forth). These advantages allow accurate recording, optimized visualization, and improved recognition of slight increases of soft tissue density, small fibrous strands, and low-contrast calcifications, which is important for recognition of malignancies that are surrounded by radiographically dense tissue. Other advantages include reduction of underexposed or overexposed films and the potential use

of artificial intelligence to support both inexperienced (by computer-aided diagnosis) and experienced radiologists, (eg, by prescreening for microcalcifications). Finally, facilitated and reliable archiving and retrieval become possible, and the combination of DLR and telerradiography systems also became possible. The major disadvantage of DLR is the limited resolution of the image detector (about 10 lines/mm) compared with film-screen mammography (about 15 lines/mm). Other disadvantages include problems with processing and transmission speed, the storage capacity of present systems, high costs, and limited availability.

Evaluation of DLR is presently underway, with special emphasis on improvement of image quality [1,2,3], optimization of postprocessing algorithms, and develop-

Abbreviations

DLR—digital luminescence radiography; PET—positron emission tomography.