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NEWS

RSNA Press Release

Computers Work as "Second Readers" in Mammographic Breast Cancer Screening

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OAK BROOK, Ill.-- Computer-aided diagnosis (CAD), used in conjunction with mammography, holds promise not only for identifying cancerous breast lesions at an early stage, but for showing which lesions are very likely benign, according to a Duke University Medical Center study that appeared in the May issue of the journal *Radiology.*

Mammographers face two challenges when screening women for breast cancer: detecting and localizing small lesions in the breast tissue, and determining whether an identified lesion is cancerous or benign. For both these tasks, radiologists are increasingly calling on computers to supplement their experience and clinical judgment. "CAD has emerged as one of the most exciting developments in medicine in recent years," according to Joseph Lo, Ph.D., coauthor of the study and assistant research professor of radiology and biomedical engineering and director of the Biophysics Study Program at Duke.

CAD is the application of computational methods, embodied in special software, to the task of interpreting breast images. As proposed in this study, it is not meant to be an isolated diagnostic measure or a routine part of mammography, but is used in conjunction with other medical data (age, family history, clinical breast exam) to clarify suspicious or indeterminate mammograms. The new study uses CAD to evaluate two cardinal signs of breast cancer: masses and calcifications.

Mammography, as commonly practiced, is a sensitive study - that is, it turns up many masses and clusters of small calcium deposits (microcalcifications) that might or might not represent cancer. It does not, however, have what statisticians call "high positive predictive value." Only about one in three women who have a breast biopsy because of what the mammogram shows turns out to actually have a malignant tumor. The number of negative biopsies is substantial, with the result that many women suffer unnecessary anxiety, discomfort, and expense. This is one of the reasons some experts (notably in Europe) are becoming skeptical about the value of breast cancer screening. With CAD, lesions that are identified as likely benign may be followed over the short term without being biopsied.

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How it works

CAD employs an artificial neural network, a type of computer software that is designed to work in the same way as neural networks in the brain. A successful network, according to Dr. Lo, will "synthesize or merge together the various mammographic findings in order to predict if the case is very likely to be a benign lesion." To achieve this the authors trained their network, using more than a thousand actual cases featuring both masses and microcalcifications, to minimize errors and correctly predict the biopsy outcome from the mammographic findings. Once trained, the network can evaluate a new patient in a fraction of a second. It runs easily on any personal computer, and should add very little time or cost to the diagnostic work-up.

What the study showed

Seven readers took part in this study, first using a group of nearly 1,500 mammographically suspicious lesions that could not be felt when examining the breast. The result was that CAD was significantly more accurate in answering the benign-or-malignant question when evaluating breast masses compared to microcalcifications. The same result was obtained when using CAD to analyze a second independent data sample of 1,000 cases from the University of Pennsylvania Health System. Still, clinicians are influenced by additional factors when deciding whether to recommend biopsy, such as the referring physician's preference, the patient's wishes, and possibly legal concerns. The result was that the fraction of cases referred for biopsy was about the same, regardless of whether the major mammographic finding was a mass or calcifications.

CAD: present and future

Dr. Lo and his colleagues believe that the logical next step is to treat masses and calcifications as entirely separate kinds of information when evaluating new CAD models for diagnosing breast cancer. "CAD already is having a direct impact on current screening practices for breast cancer," they state, and on lung cancer screening as well. CAD has the potential to contribute to disease management in many ways - including detection, diagnosis, and treatment. The authors believe that, acting as a "computerized second reader," CAD will find more cancers at an earlier stage. At the same time it will reduce false alarms that expose women to unneeded stress and pain and make cancer screening even more costly.

Radiology is a monthly scientific journal devoted to clinical radiology and allied sciences. The journal is edited by Anthony V. Proto, M.D., School of Medicine, Virginia Commonwealth University, Richmond, Virginia. Radiology is owned and published by the Radiological Society of North America, Inc. (http://radiology.rsnajnls.org)

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"Differences Between Computer-aided Diagnosis of Breast Masses and That of Calcifications." Also contributing to this paper are Mia K. Markey, B.S., and Carey E. Floyd, Jr., Ph.D.

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