From the 2011 annual meeting of the Radiological Society of North America

Advances in imaging aid detection of cancer

The following reports are based on presentations at the 2011 annual meeting of the Radiological Society of North America, held November 27–December 2, 2011, in Chicago.

Family history data support annual mammograms in 40s

SUSAN BIRK

Women aged 40–49 years with and without a family history of breast cancer had almost the same rates of invasive disease in a retrospective analysis of data on more than 1,000 patients diagnosed over a 10-year period at a single site.

The finding adds weight to the American Cancer Society's recommendation in favor of annual screening mammograms for women beginning at age 40, said principal author Dr. Stamatia V. Destounis of Elizabeth Wende Breast Care LLC in Rochester, NY. Dr. Destounis presented the results of her study in a press briefing.

A study presented at last year's meeting by researchers at the London Breast Institute of the Princess Grace Hospital indicated that annual mammograms could reduce by half the risk of mastectomy in women who were diagnosed with breast cancer between the ages of 40 and 50 years.

Both studies challenge the recommendation against routine annual mammography for women under the age of 50 made in 2009 by the US Preventive Services Task Force.

"These conflicting recommendations have led to confusion among patients and physicians," Dr. Destounis said. In the present study, she and her colleagues analyzed data on women between the ages of 40 and 49 years who underwent screening mammography at the center between 2000 and 2010.

In all, 1,116 cancers were found in 1,071 patients aged 40–49 years. Of those patients, 373 were diagnosed by screening mammography, and of the 373, 144 (39%) had a family history of breast cancer, 228 (61%) did not, and 1 patient did not know her family history. (A total of 7 patients with and 16 patients without a family history of breast cancer also had a personal history of breast cancer.) Among women with a family history, 32% (46) had a first-degree relative with a premenopausal history, 38% (54) had a first-degree relative with a postmenopausal history, and 31% (44) had a second- or third-degree relative with a pre- or postmenopausal history of the disease.

The incidence of invasive breast cancer was virtually the same—63% (91) and 64% (146), respectively—in women with and without a family history. The incidence of noninvasive disease in the two groups was also similar, at 37% and 36%, respectively. Those with and without a family history shared similar rates of lymph node metastatic disease (31% and 29%) as well. "Family history did not seem to [affect] the rate of invasive disease in our patient cohort," Dr. Destounis said.

The following lesions were found in women with and without a family history, respectively: mass (42, 86), microcalcification (69, 97), mass with calcification (21, 18), architectural distortion (11, 18), and asymmetry (1, 9).

All 144 patients with a family history of breast cancer and 227 of 228 patients in the group without a family history proceeded to surgery. One patient had metastatic disease and opted for no surgery or treatment.

In women with and without a family history, 63% and 68%, respectively, underwent a lumpectomy. Some of those patients did not have clear margins after surgery and went on to mastectomy. In all, 38% (54) of women with a family history and 31% (71) women without a family history underwent mastectomy.

Since no difference in the rate of invasive breast cancer between women with and without a family history was found in this population, "the recommendation should be that women in their 40s have a screening mammogram yearly," Dr. Destounis said. She and her colleagues are currently collecting additional data on breast density, demographics, and survival rates for this patient group.

Dr. Destounis has been an investigator for Siemens AG, Fujifilm Holdings, Hologic Inc., and Koning Corp. She has also served as an advisory board member for Philips Electronics and Matakina International Ltd.

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Mismatch between breast and mammogram detector size results in excess irradiation

PATRICE WENDLING

A mismatch between breast size and detector size during mammography resulted in significantly higher radiation doses for women with large breasts in a study of 886 patients. On average, women with large breasts screened on a small detector received almost 5 mGy of irradiation, which exceeds the American College of Radiology guidelines of 3–4 mGy or less for a standard two-view mammogram.

When a mismatch occurs, women with large breasts receive significantly higher doses of irradiation than do women with small breasts or their counterparts with large breasts correctly matched to a large detector, Dr. Cathy Wells said when presenting the award-winning study.

"Women with large breasts should be imaged with a large detector to avoid an unnecessary increase in radiation dose," she urged.

The quality assurance study involved 886 women who presented for screening or diagnostic mammography during a 6-week period in late 2009. The exams were performed with a phosphor charge-coupled device (CCD) detector, which is available in preset sizes (large or small) due to manufacturing constraints, she said. Insufficient data for 22 patients left 426 screening and 438 diagnostic patients evaluable for analysis.

A sizeable number, or almost 20% of patients, were affected by a mismatch between breast and detector size, said Dr. Wells, who completed the study at Beth Israel Deaconess Medical Center and is now a breast imaging fellow at Massachusetts General Hospital, both in Boston.

The percentage of mismatches varied from 10% of screening patients with large breasts, defined as a C cup or larger, to 27% of screening patients with small breasts imaged with a large detector. A mismatch occurred in 22% of diagnostic mammography patients with large breasts and 17% of diagnostic patients with small breasts.

Despite the sizeable number of mismatches in the study, not all women will be faced with this problem when they arrive for their mammogram, Dr. Wells said in an interview. The phosphor CCD detector is one of four types of digital detectors currently available in the United States and, to her knowledge, the only type that has such size constraints. In addition, not all imaging centers use this detector type.

'Women with large breasts should be imaged with a large detector to avoid an unnecessary increase in radiation dose.'

Some centers, including her own, have both large- and small-sized detectors available, although there can be a wait for the proper size, she noted. Women can choose to wait or be imaged with a different detector after a discussion with the technologist.

"The best option for women to ensure a correct match between breast size and detector size would be to talk with the technologist who performs the actual mammogram, [as] the scheduler or person at the check-in desk will likely not know the answer," Dr. Wells said. "Women could ask the technologist whether the detector comes in different sizes, since not all do, and if so, whether they are correctly matched."

Screening mammogram patients with correctly matched breast and detector sizes received an average mean glandular dose per breast of 3.3 mGy, compared with 4.9 mGy for mismatched patients with large breasts ($P < 0.05$). The higher radiation dose correlated with a significant increase in number of views obtained in mismatched patients with large breasts (mean, 5.9 views), compared with both large-breast patients imaged on a large detector (4.6 views) and small-breast patients imaged on a small detector (4.7 views; $P < 0.05$), Dr. Wells said. Small-breast patients mismatched to a large detector underwent a similar number of views (mean, 4.6 views) but actually received slightly less irradiation (mean, 2.9 mGy; $P < 0.05$).

During diagnostic mammograms, the radiation dose was again significantly higher among mismatched patients with large breasts, compared with the correctly matched large- and small-breast groups (8.2 mGy vs 6.7 mGy, respectively; $P < 0.05$), but it did not seem to be related to the number of views obtained, she said, adding that other factors must be at work. Several variables contribute to radiation dose, but in this case, the most likely culprit is compression thickness, Dr. Wells said. "It might be more difficult to adequately compress a large breast with a small detector, resulting in a larger radiation dose. We hope to analyze the data again to answer this question."

Dr. Wells reported no conflicts of interest.

Multiparametric MRI helps identify prostate cancer patients for surveillance

PATRICE WENDLING

Multiparametric MRI was superior to National Comprehensive Cancer Network (NCCN) guidelines in correctly classifying patients with prostate cancer as active surveillance candidates in a retrospective study of 126 men.

NCCN guidelines misclassified 22 of the 126 patients, compared with 12 who were classified using multiparametric magnetic resonance imaging (MP-MRI). When MP-MRI was added to the NCCN criteria, however, only five patients were misclassified, Dr. Baris Turkbey reported in an award-winning paper at the meeting. "Presently, MRI is not in any urology guideline, but we want to change that. Our goal is to create [a National Cancer Institute] prostate cancer nomogram that includes multiparametric-MRI, and our scientists are close to finishing it."

Dr. Turkey, a fellow in the division of cancer treatment and diagnosis at the National Institutes of Health in Bethesda, Maryland, and his colleagues, evaluated 126 men with biopsy-proven prostate cancer who underwent 3T MP-MRI of the prostate and subsequent radical prostatectomy at a median of 48 days. Their mean age was 59 years and mean prostate-specific antigen (PSA) level, 6.67 ng/mL.

MP-MRI images were obtained of the largest and most aggressive lesion using T2-weighted MRI, diffusion-weighted MRI, MR spectroscopy, and dynamic contrast-enhanced MRI. Each dominant lesion was then assigned an MP-MRI score of low (at least two positive sequences), moderate (three positive sequences), or high (four positive sequences).

Patients were eligible for active surveillance on MP-MRI if they had a dominant tumor of < 0.5 cm^3 without extracapsular extension or seminal vesicle invasion and a low imaging score. The NCCN criteria for active surveillance is T1c disease, Gleason score of 6 or lower, fewer than three positive biopsy cores, PSA level < 10 ng/mL, and PSA density < 0.15 ng/mL/g.

Based on histopathologic findings, 14 of 126 patents were eligible for active surveillance, with the remaining 112 candidates for active whole gland treatment. NCCN guidelines wrongly classified 5 of the 14 active surveillance patients and 17 of the 112 active treatment patients, whereas MP-MRI wrongly classified 1 active surveillance and 11 active treatment patients. The sensitivity, specificity, and overall accuracy of the NCCN guidelines were 64.3%, 34.6%, and 82.5%, respectively (P = 0.00002), compared with 92.8%, 54.2%, and 90.5% with MP-MRI (P < 0.000001).

Dr. Turkbey noted that the study was limited by using a relatively simple nonweighted MP-MRI scoring system and by comparing MP-MRI with NCCN guidelines only. The researchers are currently evaluating a system in which the various parameters are weighted to obtain better predictions.

Dr. Turkbey reported no conflicts of interest. A coauthor reported serving as a researcher for Koninklijke Philips Electronics, General Electric, Siemens, Hoffman-La Roche, and iCAD.

Tomosynthesis offers detection benefits in dense-breast cases

PATRICE WENDLING

The addition of tomosynthesis to full-field digital mammography improved cancer detection and reduced recall rates in women with dense breasts in a study of 293 patients.

"Both clinically and in trials, we've seen that tomosynthesis offers benefit for all women, but there is a particular benefit—the increased gains are more—for women with dense breast tissue," said Dr. Elizabeth Rafferty of Massachusetts General Hospital, Boston. "That underscores where we may start our triage efforts with limited resources."

Dr. Rafferty reported on an enriched case set of 69 biopsy-proven cancers, 74 benign biopsies, 50 recalled screening cases, and 100 negative screening cases, all with a BIRADS density score of 3 (heterogeneously dense) or 4 (extremely dense). Calcification was present in 25% and noncalcification in 75% of cases. Eight radiologists read the cases in two separate sessions separated by a month, with half of the cases read in each mode for each reading session. Identification of the lesion location and type and initial BIRADS score (0, 1, 2) were used to determine the recall rate. A probability of malignancy score from 0% to 100% was used to calculate the receiver operating characteristic area under the curve (AUC).

The difference in the AUC between

standard full-field digital mammography (FFDM) plus tomosynthesis and FFDM alone was significantly higher at 8.3% for all cases (AUC, 0.940 vs 0.857, respectively; $P < 0.0001$), 4.1% for calcification cases (0.818 vs 0.777; $P = 0.048$), and 11% for noncalcification cases (0.977 vs 0.867; $P = 0.0001$), reported Dr. Rafferty, director of breast imaging at Massachusetts General Hospital in Boston.

The recall rate for all cancer cases was 9.7% higher for FFDM plus tomosynthesis versus FFDM alone. Specifically, it was 3.8% higher for calcification cases and 14.3% higher for noncalcification cases.

Seven of the eight readers increased their cancer detection rate using FFDM plus tomosynthesis, and one reader had the same detection rate on the two modalities. For six of the seven readers, the improvement in cancer detection was statistically significant, she said.

For non–cancer screening cases, the recall rate for FFDM plus tomosynthesis was 23.3%, compared with 33.9% for FFDM alone, representing a 31% reduction in the non–cancer recall rate.

Six of the eight readers had significant decreases in their screening recall rate using the combined imaging modality, and two had no significant change.

"In women with dense breast tissue, tomosynthesis, when added to FFDM, seems to offer particular value both in terms of sensitivity as well as specificity of the examination," Dr. Rafferty said. She added that the numbers were too small to identify a difference in performance with FFDM plus tomosynthesis between dense and extremely dense breasts.

In response to a question about whether she would recommend using tomosynthesis in lieu of screening ultrasound, Dr. Rafferty replied that "in terms of the positive predictive value of screening ultrasound, I think that screening mammography, or some form of screening mammography, is going to remain the mainstay…but in terms of our diagnostic evaluation, ultrasound has become an incredibly important tool in the diagnostic evaluation. Tomosynthesis examination plus ultrasound has become [for me, and perhaps others] a kind of go-to regimen instead of using additional views. The two are very complementary."

Dr. Rafferty reported no relevant financial disclosures. A coauthor reported serving as a patent holder and employee of Hologic Inc.