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NEWS

RSNA Press Release

New Nuclear Breast Imaging Technologies Associated with Higher Cancer Risks

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At A Glance

- A single BSGI or PEM exam performed on a 40-year-old woman is associated with a lifetime risk of cancer more than 20 times that of digital mammography.
- The radiation dose from a typical screening mammography exam is equivalent to two months' natural background radiation.
- The radiation dose from a single BSGI or PEM exam is equivalent to two to three years' natural background radiation exposure.

OAK BROOK, Ill. — Some nuclear-based breast imaging exams may increase a woman's risk of developing radiation-induced cancer, according to a special report appearing online and in the October issue of *Radiology*. However, the radiation dose and risk from mammography are very low.

"A single breast-specific gamma imaging (BSGI) or positron emission mammography (PEM) examination carries a lifetime risk of inducing fatal cancer greater than or comparable to a *lifetime* of annual screening mammography starting at age 40," said the study's author, R. Edward Hendrick, Ph.D., clinical professor of radiology at the University of Colorado-Denver, School of Medicine in Aurora, Co.

The risks and benefits of screening mammography are under constant scrutiny. Meanwhile, newer breast imaging technologies, such as BSGI and PEM have been approved by the U.S. Food and Drug Administration (FDA) and introduced into clinical practice. Preliminary studies have shown both to be promising at detecting cancer; however, both involve the injection of radioactive material into the patient.

BSGI uses a high-resolution gamma camera that allows for imaging with mild compression of the breast along with an injection of a nuclear radiotracer, which is absorbed at a higher rate by cancerous cells. In PEM, radioactive material is injected into the body to measure metabolic activity and determine the presence of disease. Other technologies, not yet approved by the FDA, include dedicated breast CT and digital breast tomosynthesis.

Dr. Hendrick reviewed recent studies on radiation doses from radiologic procedures and organ doses from nuclear medicine procedures, along with Biologic Effects of Ionizing Radiation (BEIR) VII age-dependent risk data, to estimate the lifetime risk of radiation-induced cancer incidence and death from breast imaging exams using ionizing

radiation.

Two-view digital mammography and screen-film mammography were found to have an average lifetime risk of fatal breast cancer of 1.3 and 1.7 cases, respectively, per 100,000 women aged 40 years at exposure and less than one case per one million women aged 80 years at exposure. Annual screening mammography (digital or screen-film) performed in women from age 40 to age 80 is associated with a lifetime risk of fatal breast cancer of 20 to 25 cases in 100,000.

"Two-thirds of mammography units in the U.S. are now digital, which, on average, exposes the patient to an even lower radiation dose than screen-film," Dr. Hendrick said. "Manufacturers and breast centers continue to take steps to lower radiation doses on digital mammography systems without negatively affecting image quality."

Dedicated breast CT and digital tomosynthesis were both found to have an average lifetime risk of fatal breast cancer of 1.3 to 2.6 cases, respectively, per 100,000 women 40 years of age at exposure.

A single BSGI exam was estimated to involve a lifetime risk of fatal cancer 20 to 30 times that of digital mammography in women aged 40 years, while the lifetime risk of a single PEM was 23 times greater than that of digital mammography. In addition, while mammography only slightly increases a woman's risk for breast cancer, BSGI and PEM may increase the risk of cancers in other organs as well, including the intestines, kidneys, bladder, gallbladder, uterus, ovaries and colon.

People are exposed to radiation from natural sources all the time. The average person in the U.S. receives an effective dose of about 3 millisieverts (mSv) per year from naturally occurring radioactive materials and cosmic radiation from outer space. The average effective dose from two-view screen-film (0.56 mSv) or digital mammography (0.44 mSv) is equivalent to approximately two months of natural background radiation, while the effective doses from PEM and BSGI exams (ranging from 6.2 mSv to 9.4 mSv) equal approximately two to three years of natural background radiation exposure.

Currently, no one is advocating using PEM or BSGI as a screening method to replace mammography. These exams are typically performed on women with suspicious breast lesions and in women with dense breasts who are difficult to examine with other techniques. Despite the increased radiation dose, these exams have shown promise in detecting cancer accurately and may have a good risk-benefit ratio for some specific indications.

"The primary tool for breast cancer screening is still mammography, which has a very low radiation dose and a very low lifetime risk of cancer induction," Dr. Hendrick said. "The risk of missing a breast cancer because mammography is not done far outweighs the tiny risk of mammography causing a breast cancer."

He added that the subset of women under 40 who are known to be at higher risk of breast cancer should consider being screened with breast ultrasound or breast MRI, both of which deliver no ionizing radiation and have sensitivities to breast cancer that are unaffected by higher breast density.

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"Radiation Doses and Cancer Risks from Breast Imaging Studies." Disclosures: Dr. Hendrick is a consultant to

GE Healthcare regarding digital breast tomosynthesis and a member of the medical advisory boards of Koning (dedicated breast CT) and Bracco (MR contrast agents). No support from any industry source was provided for this study, and the study results have not been shared with or in any way influenced by commercial entities.

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