RSNA Press Release

Machine Learning Identifies Breast Lesions Likely to Become Cancer

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OAK BROOK, Ill. — A machine learning tool can help identify which high-risk breast lesions are likely to become cancerous, according to a new study appearing online in the journal Radiology. Researchers said the technology has the potential to reduce unnecessary surgeries.

At A Glance

- Researchers trained a machine learning model to identify high-risk lesions that are unlikely to become cancerous.
- The model was accurate in 97 percent of its predictions.
- Machine learning has the potential to reduce unnecessary breast surgeries by one-third.

Manisha Bahl, M.D., M.P.H.

High-risk breast lesions are biopsy-diagnosed lesions that carry an increased risk of developing into cancer. Because of that risk, surgical removal is often the preferred treatment option. However, many high-risk lesions do not pose an immediate threat to the patient’s life and can be safely monitored with follow-up imaging studies, sparing patients the costs and complications associated with surgery.

“There are different types of high-risk lesions,” said study author and radiologist Manisha Bahl, M.D., M.P.H., from Massachusetts General Hospital (MGH) and Harvard Medical...
School, both in Boston. “Most institutions recommend surgical excision for high-risk lesions
such as atypical ductal hyperplasia, for which the risk of upgrade to cancer is about 20
percent. For other types of high-risk lesions, the risk of upgrade varies quite a bit in the
literature, and patient management, including the decision about whether to remove or
survey the lesion, varies across practices.”

Dr. Bahl and colleagues at MGH studied the use of a machine learning tool to identify
high-risk lesions that are at low risk for upgrade to cancer. The study resulted from a close
collaboration between researchers at the Massachusetts Institute of Technology’s (MIT)
Computer Science and Artificial Intelligence Laboratory in Cambridge, Mass., and breast
imaging experts at MGH.

“Because diagnostic tools are inexact, there is an understandable tendency for doctors to
over-screen for breast cancer,” said coauthor Regina Barzilay, Ph.D., the Delta Electronics
Professor of Electrical Engineering and Computer Science at MIT. “When there’s this much
uncertainty in data, machine learning is exactly the tool that we need to improve detection
and prevent overtreatment.”

Machine learning is a type of artificial intelligence in which a model automatically learns
and improves based on previous experiences. The model developed by researchers analyzed
traditional risk factors such as patient age and lesion histology, along with several unique
features, including words that appear in the text from the biopsy pathology report. The
researchers trained the model on a group of patients with biopsy-proven high-risk lesions
who had surgery or at least two-year imaging follow-up. Of the 1,006 high-risk lesions
identified, 115, or 11 percent, were upgraded to cancer.

After training the machine learning model on two-thirds of the high-risk lesions, the
researchers tested it on the remaining 335 lesions. The model correctly predicted 37 of the
38 lesions, or 97 percent, that were upgraded to cancer. The researchers also found that use
of the model would have helped avoid almost one-third of benign surgeries.

The machine-learning model identified the terms “severely” and “severely atypical” in the
text of the pathology reports as associated with a greater risk of upgrade to cancer.

“Our study provides ‘proof of concept’ that machine learning can not only decrease
unnecessary surgery by nearly one-third in this specific patient population, but also can
support more targeted, personalized approaches to patient care,” said the paper’s senior
author, Constance Lehman, M.D., Ph.D., professor at Harvard Medical School and Director
of Breast Imaging at MGH.

“Our goal is to apply the tool in clinical settings to help make more informed decisions as to
which patients will be surveilled and which will go on to surgery,” Dr. Bahl added. “I
believe we can capitalize on machine learning to inform clinical decision making and
ultimately improve patient care.”

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“High-Risk Breast Lesions: A Machine Learning Model to Predict Pathologic Upgrade and Reduce
Unnecessary Surgical Excision.” Collaborating with Drs. Bahl, Barzilay and Lehman were Adam B. Yedidia,
M.Eng., Nicholas J. Locascio, M.Eng., and Lili Yu, Ph.D.