Transcript Details
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Breast Cancer Care Advancements: Using AI to Detect Lymph Node Metastasis

Announcer:
You're listening to *Project Oncology* on ReachMD. On this episode, we'll discuss a recent study that explored the use of machine learning to predict lymph node metastasis in breast cancer patients with Dr. Basak Dogan. Dr. Dogan is a Clinical Professor of Radiology and the Eugene P. Frenkel Endowed Scholar in Clinical Medicine at UT Southwestern Medical Center, where she serves as a member of its Breast Imaging Division and the Director of Breast Imaging Research. Let's hear from her now.

Dr. Dogan:
The main goal of our study is to try to identify axillary lymph node metastasis in breast cancer patients without using any interventions or extra diagnostic imaging or surgical methods. To understand why we wanted to do this and how it's going to add to the patient's care I want to give some background. How are we doing it now? Patients who have breast cancer, most of the time they have dedicated imaging of the axilla. We can identify some of the nodes that are abnormal there and refer to the patients for a needle biopsy if we see anything abnormal, so that involves another biopsy for the patient, and 50 percent of the time, it comes back as malignant; 50 percent of the time it comes back as benign.

And patients who either have no imaging findings or they're deemed benign on needle biopsy have a surgical procedure called a sentinel lymph node biopsy. The way this is done is the patient gets a radioactive injection, which involves extra radiation for her, and then she goes to surgery, and the lymph nodes that uptake those the radioactive pharmaceutical are removed and at least two to three nodes are removed. To deem that sentinel lymph node biopsy as successful, at least two to three lymph nodes have to be removed. So that's a surgical exploratory procedure for the patient.

So as you can see, it's such a lengthy and arduous process to decide if there is metastasis or not, and the majority of those sentinel lymph node biopsies end up being benign. And when we look at how many we catch on imaging, really we miss half of the cancers in patients who their lymph nodes are discovered at surgery. So we wanted to solve this problem because we are really good at diagnosing breast cancers from imaging, but we're not that good at diagnosing lymph node metastasis at imaging.

The role that breast MRI plays in this entire prediction model is the pixels generated from the contrast is utilized to feed into the AI model, and for our study, we didn't just use one sequence. So the way the breast MRI works is we put the patient through multiple sequences. They all look at different chemical structures within the breast, and for our study, we use them all, so we used all of the sequences that we have available. And the timeline of how contrast behaves there as well—meaning that's where the 4D model comes into play—so we used the temporal behavior of the contrast too. So this is not something we can employ with other methods, such as mammography and ultrasound, which are a quite static so we don't know how the contrast behaves in them. So we actually went back and looked at how much each pixel contributed to the prediction, and we did maps of the prediction, and there were certain areas of the tumor that in certain sequences that contributed more than others, so we did analyze that as well. So it's very important to have that timeline of sequences, and that seemed to be very important in the prediction.

We found almost 90 percent sensitivity, and we did set our threshold to that sensitivity because that's the benchmark currently being used to define the sensitivity for sentinel lymph node biopsy. So if you're 90 percent sensitive, meaning if you're finding 90 percent of the metastasis for each procedure, then the method is considered to be successful.

One of the good things about using AI models is they're scalable. So if there's a patient in which finding the nodal mets is not that important, then the model sensitivity can be scaled lower. And if you wanted to catch every lymph node metastasis there is, then you

could actually utilize the model at a much higher sensitivity, which is really the benefit of the AI models. So if we optimized it at a 90 percent sensitivity, we found that we would be saving over half of the patients who would normally get a sentinel lymph node biopsy with benign results, meaning an unnecessary axillary surgery. So I think that is really important because sentinel node biopsy still carries a risk of lymphedema. There's a 24 percent chance of subclinical lymphedema with sentinel lymph node biopsy, and even lower, about 10 percent of clinical lymphedema, so that means that person can't use their arm because we'll have swelling; and all to discover a benign outcome from their surgery, so just a diagnostic surgery. So it seems like it would be very beneficial for the patients just to spare them these unnecessary surgeries.

Announcer:
That was Dr. Basak Dogan talking about using machine learning to predict lymph node metastasis in breast cancer. To access this and other episodes in our series, visit *Project Oncology* on ReachMD.com, where you can Be Part of the Knowledge. Thanks for listening!