DR. MARTIN YAFFE AND MELISSA NOCK

ENTER ANOTHER DIMENSION
DIGITAL TOMOSYNTHESIS ENHANCES BREAST CANCER DETECTION WITH A 3-D SNAPSHOT

Medical science has become increasingly dimensional in the last several years, good news for anyone who might have suffered from the flatter alternative.

Digital tomosynthesis (DT), an investigational breast imaging technique, creates a three-dimensional picture of the breast using multiple x-rays snapped from several angles. The information is sent to a computer, where it's assembled to produce clear, highly focused, 3-D portraits of a woman's breast.

Mammography usually takes two x-rays of each breast from different angles: top to bottom, side to side. Detecting a tumour inside it is a bit like finding the jelly in a donut with a couple of knife slices. Better to carve up the pastry, piece by piece, in search of the spot of jam.

The more accurate latter pursuit — exit bakery, enter lab — has been made easier over the years with increasing technical attention to mammography that has ushered its entrée into the digital field, replacing film with an electronic detector. This has enabled radiologists to acquire the image more precisely and enjoy the freedom to manipulate, enhance and share it digitally; to use computer-aided algorithms in cancer detection and diagnosis; to create functional contrast-enhanced images that display the effects of tumour angiogenesisis; and to perform DT, among the most exciting applications on the improved digital mammography platform.

Where a mammographic image is a projection of the 3-D information in the breast onto a flat plane, DT creates 3-D images that explode the structures into a more lifelike materialization, a transformation, says Dr. Martin Yaffe, a senior scientist at Sunnybrook Research Institute (SRI) and co-principal investigator of the Breast Cancer Research Centre at SRI and Toronto Sunnybrook Regional Cancer Centre (TSRCC), that may help to detect breast cancer more accurately and avoid false positives.

Tomosynthesis uses a standard digital mammography machine, but angulates the x-ray tube at different angles to the stationary digital detector. The resultant set of 11 to 15 images is subject to calculations that combine the data to reconstruct a 3-D computer image. "When you look at it, it's as if you're looking through the breast, slice by slice," says Yaffe.

SRI's DT system, a $750,000 miracle that's part of a research collaboration with GE Healthcare, is destined for three clinical research studies: With Yaffe, lead investigator Dr. Roberta Jong, director of breast imaging at Sunnybrook/TSRCC, will test the role of DT in screening; in diagnostic examinations; and as a new technique, contrast-enhanced tomosynthesis.

"Our overall goals," Yaffe says, "are to help improve the early detection of breast cancer for better outcomes. Digital tomosynthesis is a means of doing that." LP