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CADstream Optimizes Interpretation of Breast MRIs

■ KIRKLAND, Washington—CADstream, a new computer-aided detection system designed specifically for breast magnetic resonance imaging (MRI) (see image on page 2), is streamlining the processing and interpretation of these increasingly common studies. The system dramatically cuts the time radiologists need to read a breast MRI, provides higher-quality images and more-detailed information to guide treatment planning, and may reduce the false-positive rate of manually read breast MRIs.

Dr. Smith

Dr. Porter

"CADstream was designed to help radiologists interpret breast MRIs efficiently, effectively, and accurately," said Justin P. Smith, MD, medical director of Confirma, the company that developed the system, and a radiologist at First Hill Diagnostic Imaging, Seattle. The system, first marketed in January 2003, automates and standardizes the processing of the hundreds or even thousands of images obtained from a single breast MRI study and allows radiologists to quickly extract and view critical information in the MR images.

The rapidly increasing use of breast MRI in the United States, coupled with the limited number of radiologists who are well trained in reading these images, highlights the value of such a tool, noted Bruce A. Porter, MD, medical advisor to Confirma and medical director of First Hill Diagnostic Imaging.

"Because breast MRI is increasing at a rate of 30% to 40% per year, it is now starting to move into the mainstream," he said. "This means that radiologists with less experience will start to do this exam, and a tool like the CADstream system will be useful for them to both speed their interpretations and make their interpretations more reproducible."

CADstream's Features

The current version of the CADstream system (v. 3.0) has about a dozen features to optimize the processing and interpretation of breast MRIs. Images imported to the system directly from the MRI scanner are first registered to correct for patient movement, reducing artifacts. This process helps decrease false-positive readings, Dr. Smith noted. The system then produces subtraction images by comparing pre- and postcontrast images and removing nonenhancing tissue to accentuate enhancing areas that warrant a closer look.

CADstream's angiogenesis maps provide information at a glance about a lesion's biology as demonstrated in the rates of uptake and washout of contrast during imaging (see Figure 1). The system color codes individual pixels in the image according to quantitative thresholds that radiologists can vary. Color-coded images can contain red, green, and blue pixels, which indicate differing likelihoods of malignancy.

"The angiogenesis maps allow us to take a large amount of complex, dynamic breast MR data and reduce it down to a form that practicing radiologists can look at and rapidly come to a conclusion about areas of normal and abnormal enhancement," Dr. Smith commented. In addition, for any pixel in the image, the radiologist can quickly view the real-time contrast uptake and washout curves (see Figure 2).

CADstream's maximum-intensity projection (MIP) feature (see Figure 3) and multiplanar reformatting (MPR) feature allow radiologists to view enhancing lesions in three dimensions and in different planes, respectively, to better assess a lesion's relationship to surrounding structures. "There is still diversity in opinion as to what is the right plane in which to view the breasts in MRI," Dr. Smith said, noting that CADstream circumvents this issue by permitting viewing in coronal, transverse, and sagittal planes.

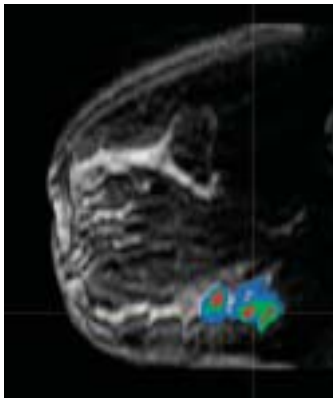
Radiologists can also use CADstream's volume summary feature to obtain more anatomic information for treatment planning. This feature displays a 3D volume reconstruction of the enhancing lesion that can be viewed and rotated, as well as data such as the lesion's volume and diameter. "3D volumes help the surgeons by showing them compactly the relationship of a given lesion in the breast to the critical structures the surgeon cares about for planning surgery, that is, the nipple, skin, and chest wall," Dr. Smith said.

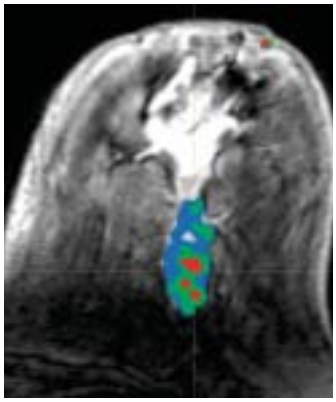
CADalyst, a new Confirma product that works with the most current version of CADstream, makes it possible for radiologists to read processed MR images from multiple and remote locations. Using this Web-based interface, radiologists can view and interact with MR images from any computer or PACS (picture archiving and communication system) workstation that is networked to the server on which CADstream resides.

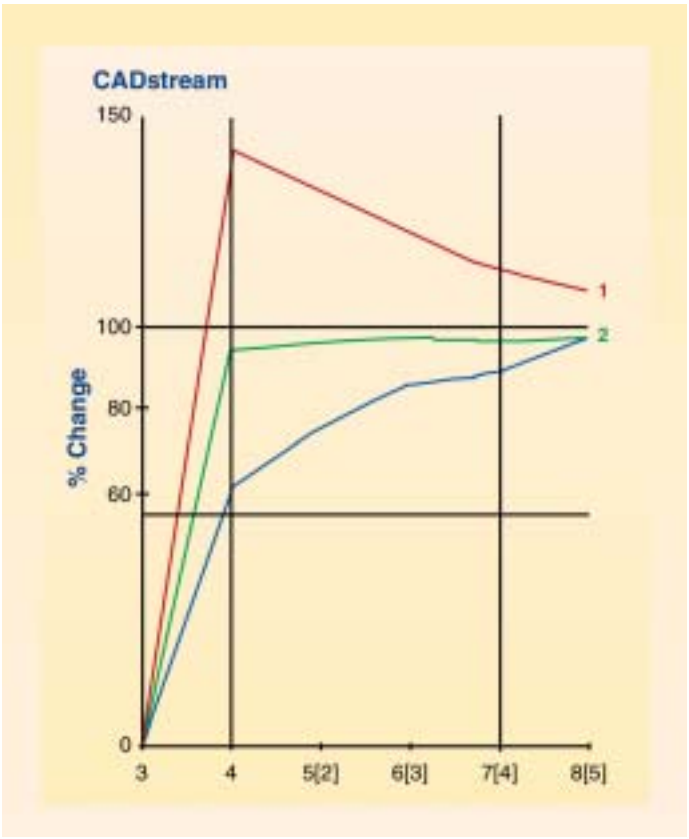
"Interpretation of breast MRIs can be laborious—we produce sometimes 1,000 or 2,000 images," Dr. Porter said. "In the past, many times the curves and MIPs and MPRs had to be done manually, and that could be a very time-consuming and sometimes exasperating process." Confirma estimates that while manual interpretation of a single breast MRI takes 30 to 40 minutes, interpretation with CAD-stream can be completed in about 10 to 15 minutes.

It automates and standardizes the processing of thousands of images

From the radiologist's perspective, the availability of CADstream has turned breast MRI into just another exam, Dr. Smith said. At First Hill Diagnostic Imaging, he said, "where we see up to seven breast MRIs a day, CADstream has turned the breast MRI into a study that is not to be feared."

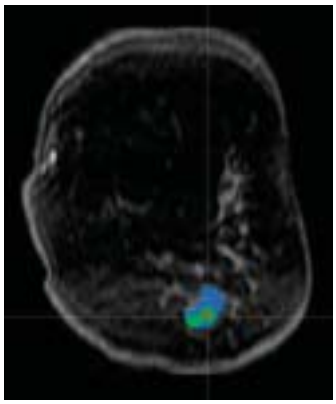




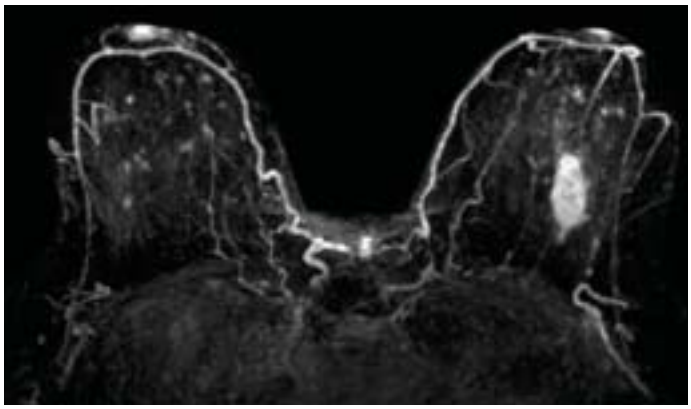


◄Figure 2. These CADstream real-time dynamic contrast curves of MRIs from the same patient as in Figure 1, interactively demonstrate contrast uptake and washout levels representative of the tissue demonstrating anolgenesis. Based on the work of Christiania K. Kuhl, MD, red washout type curves are more commonly seen with invasive neoplasms than are green curves, and green curves are more commonly associated with invasive neoplasms than are blue curves. Image courtesy of Fir Hill Diagnostic Imaging, Seattle, Washington.

▼Figure 3. CADstream maximum intensity projection (MIP) image. This feature allows radiologists to view enhancing lesions in three dimensions. Clinical image courtsey of First Hill Diagnostic Imaging, Seattle, Washington.



◄ Figure 1. CADstream anglogenesis maps in the sagittal, transverse,and coronal planes, showing regions of increased blood flow that may indicate abnormal tissue. Red • rapid uptake and washout of contrast (more commonly seen with invasive cancer than green). Green • plateau phase enhancement (more common in invasive cancer than blue). Blue • persistent enhancement. Images courtesy of First Hill Diagnostic Imaging.



Physicians may also find CADstream useful for educating patients about their cancer and helping them make difficult treatment decisions, Dr. Porter said. "MRI is unsurpassed in its ability to serve as a communication tool with patients," he commented.

Showing patients a 3D reconstruction of their cancer often changes it from an abstraction into a reality, allows them to make better treatment decisions and feel more comfortable about these decisions, and helps them to better understand the disease and why specific treatments are being recommended, he said. "As they begin to understand their cancer, they start to get their power back, and they become less of a victim and more of a colleague you can work with to help them cope with their cancer," he noted.

In a study presented at the 89th Scientific Assembly and Annual Meeting of the Radiological Society of North America (RSNA), increasing the enhancement threshold at which CADstream-processed breast MRIs were interpreted increased the specificity of the study while maintaining very high sensitivity.

The investigators, led by Connie Lehman, MD, PhD, of the University of Washington and the Seattle Cancer Care Alliance, evaluated 33 lesions (9 malignant, 24 benign) seen only on MRI. Images were analyzed both with and without CADstream, and analysis of the enhancement in CADstream-processed images was performed at three discrete thresholds (50%, 80%, and 100%).

At all three enhancement thresholds, CADstream had a sensitivity of 100% for identifying malignant lesions based on the detection of significant enhancement in these lesions.

In contrast, for benign lesions, the presence of significant enhancement varied across thresholds. At the 50%, 80%, and 100% thresholds, the false-positive rate relative to that obtained without CADstream was reduced by a nonsignificant 25%, a borderline-significant 33%, and a significant 50%, respectively.

"If these results are validated by a larger study, the number of unnecessary biopsies of MR lesions could be reduced in half without a concomitant decrease in cancer detection," the investigators concluded.

Confirma recently announced a new partnership with Hologic (Bedford, Massachusetts) that will make CADstream available nationally to mammographers in imaging centers and hospitals. Specifically, the CADstream system will be integrated with the Lorad Selenia system, a full-field digital mammography system that uses direct-capture technology. This integration will enable simultaneous viewing of mammograms and breast MRIs in the same plane.

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