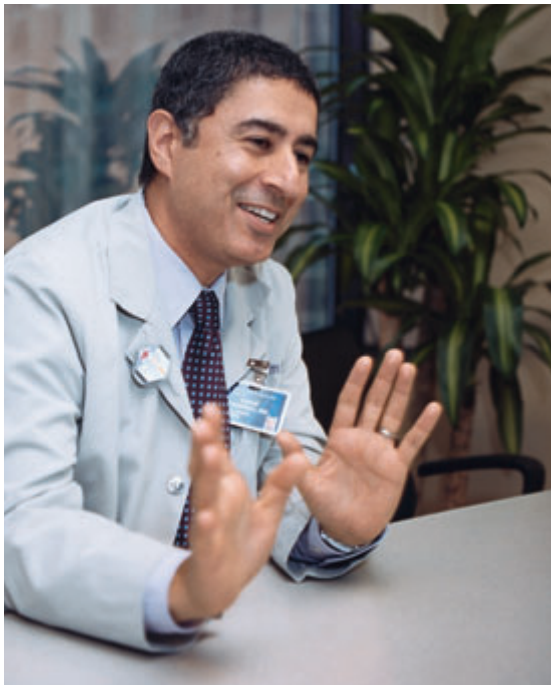


Vahid Yaghmai, MD, Associate Professor of Radiology at Northwestern University-Feinberg School of Medicine, Illinois.

Let the Computer do it!
Fully Automated Tumor Tracking With *syngo* CT Oncology

By David J. Tenenbaum

Before data becomes information, it must be thoroughly examined and analyzed. And as CT scanners produce a growing torrent of data, radiologists confront a data-or-information question every day: how to obtain the maximum patient benefit from the hundreds of slices that an advanced CT scanner produces from each patient scan?

Rigorous, accurate and repeatable analysis of CT scans is a matter of life and death in oncology, but the sheer quantity of data raises the potential for operator fatigue and even error. And these dangers are multiplied by the regular follow-up studies needed to track tumor response to treatment.

But wading through data is precisely why computers were invented. Several years ago, Siemens CT software gained the capability to automatically detect tumors. And now the new *syngo*® CT Oncology has the capability to automate lesion measurement, and even brings volume calculation into routine tumor evaluation.

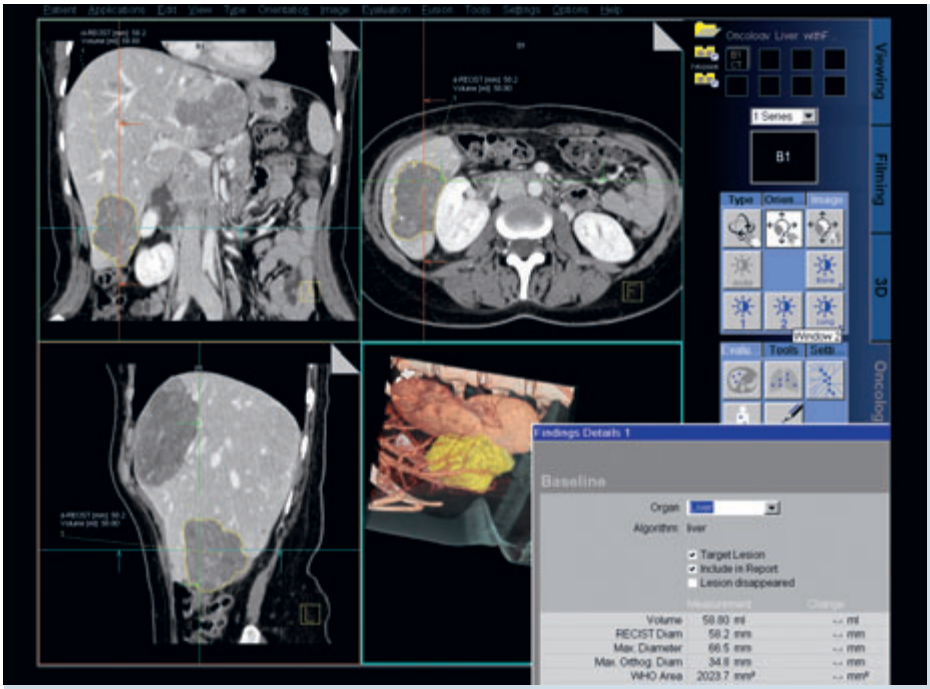
Quick, Accurate and Consistent

In preliminary tests, Vahid Yaghmai, MD, Associate Professor of Radiology at the Northwestern University Feinberg School of Medicine, Chicago, Illinois, says the software matched the best human measurements. "In our experience, we have seen an excellent correspondence between a manual measurement of lymph node and most liver tumors, and the automatic software measurement.

It's very quick, accurate and consistent in measuring lesions using the RECIST (Response Evaluation Criteria in Solid Tumors) and WHO (World Health Organization) standards." Yaghmai is Medical Director of CT at Northwestern Memorial Hospital - Northwestern University, a tertiary care hospital in Chicago with one of the largest oncology units in the United States.

In May, he reported to the American Roentgen Ray Society that manual and automatic segmentation and measurement of abdominal and pelvic lymph nodes corresponded closely, according to both RECIST and WHO criteria. Similarly, he reported to the Society of Gastrointestinal Radiologists that the software successfully segmented and measured 22 liver lesions on contrast-enhanced CT scans from 12 patients.

Fast, accurate and repeatable tumor segmentation and measurement are significant advances, but *syngo*'s new ability to automatically calculate tumor volume could have equal importance. Studies have already shown that the volume of lung tumors may be valuable for assessing progression or regression; similar studies for liver, bone and brain tumors remain to be done. Although the role of



One click 3D-segementation and size evaluation of liver lesions with *syngo* CT Oncology.

volume in determining tumor status remains subject to further research. "Intuitively, we think it should be important," says Yaghmai. "But until now, the difficulty of performing volume measurements has limited our ability to validate this."

Simplified Follow-Ups

To obtain automated measurements from the *syngo* CT Oncology*, a radiologist clicks on the lesion on the display, and immediately receives a readout of x, y, and z dimensions, RECIST and WHO measurements, and lesion volume. If the scan is a follow-up, the system displays previous data on the same lesion, and calculates any dimensional change during the interim.

A simplified follow-up is one of the biggest benefits of this new *syngo* software; there is no need to "find" the same tumor on previous images, and then determine which slice shows the greatest single dimension for RECIST or WHO measurements – those repetitive functions are now all embedded in the software. "When you follow patients based on these measurements, you want consistent and reliable data, and this software gives reliable and consistent information. It virtually eliminates human error and the variations in measurement that can occur when doing it manually," says Yaghmai. "Despite advances in technology, consistency remains a problem in radiology. There have been many studies showing that measurements of the same lesion by two observers will be different. *syngo* CT Oncology eliminates that part of the inconsistency." This improvement may be particularly important in irregular tumors, with poorly defined margins that are difficult to measure.

Better Patient Care

On the practical level, automated measurement can improve the accuracy of comparisons when patients change hospitals. "Many patients are first imaged at a small community hospital, and we want to standardize the way we are following these tumors; it's really about better patient care," says Yaghmai.

Automated measurement can also advance the state-of-the-art in oncology, by improving the accuracy of tumor assessment during clinical trials, he adds. There is much push from the National Cancer Institute to standardize the way we follow up tumors. There is a lot of variability in how different centers do follow-up, and we want to standardize how we acquire images and measure these tumors.

Greater accuracy may also help resolve long-standing questions about the relative value of RECIST and WHO standards. There is a lot of debate, but a lot of that stems from the issue of human error in manual segmentations.

syngo CT Oncology also offers workflow improvements. "In a large oncology center, measuring lymph nodes in multiple dimensions and reporting on multiple lesions in every study is a very time-consuming process," Yaghmai says. "An automated way of measuring lesions would really improve, the workflow. You decide which lesions to evaluate, and click on as many as you want. Theoretically, somebody who is not a radiologist can look at lesions on a follow-up study."

Volume as a Standard Modality?

In the longer term, automated tumor measurement can take radiology firmly into the third dimension. While each component of a CT scan is a two-dimensional slice of the patient's anatomy, tumors themselves are three-dimensional objects, and the new-found ability to measure volume will allow comparisons to see whether volume, RECIST or WHO is most appropriate for evaluating treatment. Already, data regarding the volume of lung cancer nodules "suggests that volume should be the way to follow treatment," Yaghmai says. "However, nobody knows what volume means in terms of patient management for tumors of the liver or lymph nodes. Even before the precise role of volume measurements is determined, accuracy and repeatability have value in improving patient care," says Yaghmai. "We do not want the human factor to be a component of these measurements. It's better for patient to have realistic information. Whether or not volume becomes a standard modality for evaluating treatment," Yaghmai says, "software like this will be eventually standard for any follow-up of oncology patients. Previously, the technology was not available, and now it is."

*Pending 510(k): The information about this product is being provided for planning purposes only. This product is pending 510(k) review, and is not yet commercially available in the U.S.

***David J. Tenenbaum**, reports on science, health and environment, and is co-author of Visualizing Human Biology, published by John Wiley and Sons (2007).*