

Together with Siemens, researchers at the University Hospital of Freiburg, Germany (right) have developed a uniform user interface for differentiating malignant from benign tumors (left).



Visualizing Tumor Growth

Software now under development promises to help specialists identify malignant tumors more accurately than ever before. A new graphic interface is the key.

The earlier a tumor is detected, the greater the chances of a patient's survival. Better imaging diagnostics can help here. One promising approach uses "dynamic contrast medium-enhanced magnetic resonance imaging" (DCE-MRI), a method that allows radiologists to detect the fine network of blood vessels whose growth is triggered by a growing tumor in a process known as angiogenesis. These blood vessels, which are just a few thousandths of a millimeter thick, supply the tumor with oxygen and nutrients. Unfortunately, they are too small to be detected by conventional imaging methods. To circumvent this problem, researchers in the field of DCE-MRI use a contrast medium to measure the microcirculation of blood within these minute vessel networks.

Molecules known as growth factors are involved in causing tumor blood vessels to grow. These factors also enlarge the pores in vessel walls, allowing greater quantities of a contrast medium to flow from normal blood vessels into the surrounding tumor tissue, where it accumulates. Before undergoing a magnetic resonance scan, the patient is injected with a conventional contrast medium. The MR scanner then records a succession of cross-sectional images of the suspect area for a period of, say, five minutes, providing the physician with MR signals of a high temporal resolution.

The intensity of these signals indicates the rate of flow, or "dynamic," of the contrast

medium. However, this method doesn't determine how much contrast medium flows through the pores. This is where DCE-MRI evaluation software comes in. Using modeling techniques, it generates a curve that a radiologist can use to determine whether the tumor is malignant or benign. With a benign tumor, the curve rises less steeply and falls at a later point than is the case with a malignant growth.

Up to now, there has been no commercially available software solution to differentiate between the curves produced by benign and malignant tissue. "Because researchers used their own evaluation methods, the results weren't directly comparable," says Dr. Martin Büchert of the MR Development and Application Center at the University Hospital in Freiburg, Germany. "That's why we have developed, in cooperation with Siemens, a standardized software solution — the DCE-MRI Task Card. This will improve and speed up the evaluation of clinical studies based on data from different sources."

Siemens plans to market the DCE-MRI Task Card in conjunction with its MR scanners. Thanks to its integration with Siemens' *syngo* medical interface (see *Pictures of the Future*, Fall 2006, p. 56), the software will be much easier to use than the programs currently available. At present, the DCE-MRI Task Card is still under development, but a demo package is already being tested. "Using feedback from tests, we can make the software more user-friendly," says Dr.

Ralph Strecker, who heads development of the DCE-MRI Task Card at Siemens Medical Solutions.

One person who is testing the software is Dr. Anwar Padhani, an expert in the field of DCE-MRI at the Mount Vernon Cancer Centre in London. Padhani uses the technique in clinical research and in standard radiological examinations. The radiologist rates the dynamic MR process highly, because it enables detection of many different types of cancer, including breast cancer, cervical cancer and prostate carcinomas. "I particularly like the new Siemens software's ability to display the curves in addition to the MR images within a standardized user interface," he says. "Our system can't do that because it requires the use of a separate computer. And that wastes valuable time."

Researchers are also using DCE-MRI to look for substances that block the growth factors involved in the angiogenesis process. For example, neuroradiologist Dr. Gregory Sorensen of the Massachusetts General Hospital in Boston has tested one such inhibitor against glioblastoma, an extremely malignant form of brain tumor. "The DCE-MRI showed that the test substance actually inhibits the growth factor and therefore angiogenesis," says Sorensen. "From the shape of the measurement curves, we can deduce the quality of the active substance and then estimate what dosage a patient requires and which therapy combination promises the best results." ■ Michael Lang, Ulrike Zechbauer