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Lee Meltzer

# 3T MRI:
## Road to Clinical Acceptance

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# 3T MRI: Better Coverage, More Confidence

By Judith Gunn Bronson, MS

BIGGER, FASTER, BETTER: THAT IS ALWAYS THE MANTRA FOR imaging equipment. In MRI, 1.5T scanners have largely displaced 1T systems. Now, 3T scanners are making their debut. They promise faster scans, reducing the likelihood of image degradation as a result of patient motion while increasing patient throughput. For example, a knee study can be completed in 2 minutes, and a three-dimensional image of the abdomen with submillimeter resolution can be captured in 15 seconds.

> Two 3T MRI at the NYU Medical Center MRI research facility are fast being pressed into clinical service.

Moreover, the resolution of the 3T systems is higher. Fourth-level branches of the biliary tree, 0.4-mm cervical spine rootlets, and the texture of cartilage can all be appreciated. Diffuse lung disease can be detected with higher sensitivity than is achievable using helical CT.[1] Using diffusion tensor imaging at 3T, it is possible, for the first time, to see brainstem structures (such as the white-matter tracts and deep cerebellar nuclei) clearly. With contrast-enhanced studies, significantly better differentiation between the brain and a tumor is possible, and venography gives a better picture of the tumor environment than is available at 1.5T.[2] Real-time cardiac imaging with 1.5-mm resolution and significant reductions in scan time for the coronary arteries are possible. As Schmitt et al noted of 3T systems, "Faster scanning tips an already advantageous economic outlook in favor of the user."[3]

At the same time, the problems created by higher field strength cannot be overlooked. The longitudinal relaxation time is prolonged at 3T, the chemical shift is larger, there are stronger susceptibility effects, and more radiofrequency energy is deposited in the patient's tissues.[3] Nevertheless, these problems have largely been overcome by Total imaging matrix (Tim™) technology from Siemens Medical Solutions (see adjacent sidebar).

The department of radiology at New York University Medical

## Springboard for 3T: Tim

One each of the 1.5T and 3T MRI scanners at New York University Medical Center, New York City, incorporate Siemens' Total imaging matrix (Tim™) coils, which can be purchased with as many as 102 matrix elements and 8, 18, or 32 independent radiofrequency channels. The Tim-equipped 1.5T Avanto scanner, which became available at the center in November 2003, was the first Tim installation in the United States. There are now more than 700 worldwide.

With Tim, the operator selects examinations, not coils. The technology permits massive parallel imaging in any direction. It also makes possible coverage of up to 181 cm, as might be used in musculoskeletal studies or angiography, in a single scan, without reconfiguring the coils or changing the patient's position. With Tim, signal-to-noise ratio is improved and susceptibility artifacts are reduced. The limits imposed by the specific absorption rate at high field strengths, which initially limited the clinical use of 3T scanners, are virtually eliminated.

Edmond A. Knopp, MD, is associate professor of radiology and neurosurgery and section chief for neuroradiology at New York University. He says, "Without Tim, the image quality at 3T is poor, the artifacts are considerable, and, I imagine, the patients are not particularly comfortable because of heating. With Tim, on the other hand, 3T systems are what we expected them to be: high resolution, fast, and without artifacts." He continues, "The sequences have been optimized so that there is very high resolution with advanced sequences, such as those needed for spectroscopy and diffusion tensor imaging. For example, with Tim, we are able to get high-quality spinal images without making the patients uncomfortable; on the conventional scanner, the patients tend to get heated up during such scans. At least in our hands, the Tim technology will make it possible to use 3T scanning across the board for a multitude of studies. Without Tim, many of these studies would be very difficult at 3T. We have Tim and non-Tim scanners side by side, and 3T with the Tim technology far surpasses 3T without Tim and anything the other manufacturers have—even state-of-the-art systems at other academic centers."

***—J. G. Bronson***

Center in midtown Manhattan is known for its work in neurological, abdominal, cardiovascular, and genitourinary imaging and its research in such areas as brain spectroscopy and perfusion imaging, virtual endoscopy, lung-cancer screening, cardiac MRI, and MR renography. The department recently acquired one Siemens 3T MAGNETOM Trio system equipped with Tim. The scanners are installed in a research facility, but half of their operating hours are spent on clinical scanning. “If these were clinical scanners, they would be full because of the demand for their capabilities,” according to Edmond A. Knopp, MD, associate professor of radiology and neurosurgery and section chief for neuroradiology at New York University. “In general, 3T gives higher resolution than 1.5T. Although, on the conventional scanner, there are some problems, these can be corrected with Tim. Right now, there still is more flexibility at 1.5T, but this is likely to change as more coils become available for the higher-field machines. We find 3T studies valuable for any disease of the brain or the spine, particularly demyelinating disorders, head trauma, tumors, and cerebrovascular disease. With 3T, we can do advanced diffusion and spectroscopy in the spine.” Knopp continues, “We have a research protocol in progress on subacute and chronic trauma where we run some advanced sequences known as susceptibility-weighted imaging that are ultra-high resolution. At 3T, we can appreciate microtrauma that we would not otherwise be able to see.”

Vivian S. Lee, MD, PhD, is professor and vice chair of the department of radiology at the university. She says, “We use 3T for almost all imaging indications in the body and cardiovascular system. In our experience, MR angiography, breast MRI, and abdominal-pelvic studies are particularly good at this field strength. The problems result primarily from increased susceptibility effects but, in general, we get excellent-quality cardiac MRI studies.”

## ADVICE FOR BUYERS

Lee says, “My advice to those considering purchase of a 3T system is to make sure you are clear about your expectations. In some applications, at present, 3T offers superior image quality and detail compared with 1.5T, and it can provide throughput comparable to that of the top-end 1.5T systems. The advantages of 3T may also prove compelling from a marketing perspective, depending on the environment of your imaging group. As the MRI world turns to 3T, the advantages of higher field strength are inevitably going to be realized, and participating in this process from the start is tremendously exciting.” Knopp adds, “In my opinion, if you are looking to buy a single system, 3T should not be your first choice. On the other hand, if you are an advanced center looking to add an additional scanner, then 3T with Tim is the way to go, because you cover all of your bases with advanced technology and the highest resolution possible.”

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*Judith Gunn Bronson, MS, is a contributing writer for* Decisions in Imaging Economics.

## REFERENCES


1. Lutterbey G, Gieseke J, von Falkenhausen M, Morakkabati N, Schild H. Lung MRI at 3.0 T: a comparison of helical CT and high-field MRI in the detection of diffuse lung disease. *Eur Radiol.* 2005;15:324-328.

2. Nagae-Poetscher LM, Jiang H, Wakana S, Golay X, van Zijl PC, Mori S. High-resolution diffusion tensor imaging of the brain stem at 3 T. *AJNR Am J Neuroradiol.* 2004;25:1325-1330.

3. Schmitt F, Grosu D, Mohr C, et al. 3 Tesla MRI: successful results with higher field strengths [in German]. *Radiologe.* 2004;44:31-47.


# Benefits of 3T in Oncologic Imaging

MRI has been applied for some time to oncologic imaging. For the breast, it is a valuable adjunct to mammography, being highly sensitive to invasiveness and able to detect multifocal tumors and to define the response to chemotherapy. In the liver, MRI is valuable in characterizing masses; in the view of some radiologists, MRI is superior to CT for this purpose.[1] The utility of MRI in oncology may improve further with the availability of 3T scanners. As noted by Fischbach et al,[2] the availability of high–field-strength scanners has produced a renaissance in MR spectroscopy. At 3T, with its greater speed and signal-to-noise ratio, it is possible to capture spectra from organs, such as the liver, that move with breathing. Those investigators believe that 3T MR spectroscopy will permit chemical characterization of malignant hepatic tumors.

Another oncologic application of 3T MRI is the evaluation of gliomas. A team[3] at New York University, New York City, found that relative cerebral blood volume (rCBV) was much higher in high-grade than in low-grade gliomas. Earlier work[4] by these investigators had shown that the rCBV and MR spectroscopy had high sensitivity, specificity, and positive and negative predictive values in identifying high-grade tumors of this type.

Prostate cancer was one of the first targets of MRI and MR spectroscopy, but most images were acquired using endorectal coils, which distort the gland’s anatomy. Sosna et al[5] recently demonstrated that a torso phased-array coil operating at 3T was significantly better than 1.5T endorectal coils in demonstrating elements of regional anatomy and might be an excellent way to determine the stage of primary prostate cancer.

***—J. G. Bronson***

## References


1. Hussain SM, Semelka RC. Liver masses. *Magn Reson Imaging Clin N Am.* 2005;13:255-275.

2. Fischbach F, Thormann M, Ricke J. 1H magnetic resonance spectroscopy (MRS) of the liver and hepatic malignant tumors at 3.0 Tesla [in German]. *Radiologe.* 2004;44:1192-1196.

3. Law M, Yang S, Babb JS, et al. Comparison of cerebral blood volume and vascular permeability from dynamic susceptibility contrast-enhanced perfusion MR imaging with glioma grade. *AJNR Am J Neuroradiol.* 2004;25:746-755.

4. Law M, Yang S, Wang H, et al. Glioma grading: sensitivity, specificity, and predictive values of perfusion MR imaging and proton MR spectroscopic imaging compared with conventional MR imaging. *AJNR Am J Neuroradiol.* 2003;24:1989-1998.

5. Sosna J, Pedrosa I, DeWolf WC, Mahallati H, Lenkinski RE, Rofsky NM. MR imaging of the prostate at 3 Tesla: comparison of an external phased-array coil to imaging with an endorectal coil at 1.5 Tesla. *Acad Radiol.* 2004;11:857-862.

# Contrast-Enhanced MR Angiography at 3T: Indications, Benefits, and Outcomes

By Kambiz Nael, MD; Gerhard Laub, PhD; and J. Paul Finn, MD

*Figure 1. Coronal and sagittal oblique maximum-intensity projection from contrast-enhanced MR angiography shows tight stenosis of the left carotid bifurcation (arrow) and mild irregularity along the right common and internal carotid arteries (voxel dimensions: 0.7x0.7x0.7 mm3 in a 20-second breath hold over a 440-mm field of view).*

Contrast-enhanced MR angiography (CEMRA) is becoming increasingly competitive with both catheter angiography and CT angiography (CTA) for nearly all vascular territories, with the possible exception of native coronary arteries. Over the past 5 years, steady improvements in gradient technology, pulse sequences, and postprocessing algorithms, together with dramatic improvements in radiofrequency (RF) technology, have laid the foundation for the robust current status of CEMRA applications at 1.5T. Ironically, it may be the very success of 1.5T imaging that has spurred the search for newer, less well explored fields. Recently, whole-body 3T MRI systems have become available, with the promise of greatly improved signal-to-noise ratio (SNR) in comparison to 1.5T. All else being equal (which, of course, it is not), noise diminishes linearly with field strength; 3T imaging might be expected to double the available SNR over 1.5T. Increased SNR is never a burden, but it can be an expensive commodity if it comes with too many strings attached. Going from 1.5T to 3T involves more than increasing SNR; it also awakens sleeping giants from the world of physics, and some of these pack a nasty punch. For some techniques and pulse sequences (many of which are now bread and butter for nonangiographic imaging at 1.5T), there are substantial trade-offs at 3T. The single most troublesome feature seen by 3T users is the so-called dielectric resonance effect, a phenomenon whereby troughs of MRI signal are seen corresponding to the shorter wavelength of the RF signal at 3T. The signal loss occurs at fairly consistent locations in the body, and it is most troublesome for highly RF intensive techniques. Ingenious plans are being pursued to tackle this problem, and for CEMRA, dielectric resonance effects are, at least so far, not very limiting.

> The UCLA Medical Center experience suggests that CEMRA of the carotids, thorax, abdomen, and pelvis at 3T is robust and frequently yields spectacular images using lower contrast doses than are typical at 1.5T.

Why do we want higher SNR for CEMRA? Is the current SNR inadequate? In most cases, the answer is no, and if it were not for the introduction of parallel acquisition, 3T might be a hard sell for CEMRA. Parallel acquisition speeds up an MRI measurement by using spatial information from surface coil elements to substitute for a certain percentage of the phase-encoding steps (time-consuming repetitions that have been the basis for spatial encoding for more than 20 years). With the appropriate coil arrangement and receiver chain, it is possible to accelerate an acquisition manyfold, with the specific number being called the acceleration factor. The price paid for the increased speed of parallel acquisition is a drop in SNR, and this can be severe. At 3T, there is more SNR available, so one can use higher acceleration factors and still have adequate SNR. During the same amount of imaging time, users can acquire images with higher spatial resolution and/or greater coverage than would be the case at 1.5T (where SNR breakdown is possible).

Another feature of CEMRA at 3T is that, since the longitudinal relaxation time (T1) of background increases with field strength, sensitivity to injected gadolinium agents for CEMRA is heightened, and smaller contrast doses may be used. CEMRA at 3T can often generate spectacular studies, providing three-dimensional (3D) data with high spatial resolution over a large field of view.

## CEMRA TECHNIQUES

Clinical experience with 3D CEMRA techniques at 3T, as implemented on the Siemens MAGNETOM Trio scanner, currently equipped with 32-channel multicoil technology called Total imaging matrix (Tim), covers a variety of vascular territories.

Conventional CEMRA relies on the T1-shortening effect of gadolinium-based contrast agents and is performed with a T1-weighted fast spoiled 3D gradient recalled-echo sequence. The sequence parameters and the contrast-administration scheme should be carefully planned to achieve the best compromise between the expendable SNR and the required spatial and temporal resolution. With recent advances in scanner gradient performance, temporal resolutions on the order of 2.5 to 3 milliseconds and echo times on the order of 1.2 milliseconds are achievable for 576 matrix acquisitions. This results in acquisition of a high–spatial-resolution 3D data set during a comfortable breath-holding period.

A unique feature of MRI is the ability to generate temporally resolved 3D images that depict the first-pass transit of contrast through the vascular system with subsecond temporal resolution. This type of measurement is impossible with CTA because the radiation dose would be prohibitive. Time-resolved MRA can readily provide supplemental functional information about cardiovascular hemodynamics, with relative insensitivity to motion and the requirement for only very small doses of contrast. For many applications, in-plane resolution can be preserved while through-plane resolution is traded for rapid temporal sampling.

For all CEMRA applications, precise control of contrast administration is essential, especially for high–spatial-resolution MR angiography, where the center of k-space should be aligned with the peak vascular enhancement. Timing can be easily optimized through use of a test bolus, but real-time triggering algorithms provide an alternative, if less flexible, method.

## RECENT ADVANCES

The introduction of parallel imaging is one of the most significant recent advances in MRI, and it has improved the performance of MRA applications by changing the way that data are spatially encoded. Component coil signals in an RF coil array are used for partial encoding of spatial information by substituting for phase-encoding gradient steps that have been omitted. Therefore only a subset of the k-space data, defined by the acceleration factor, is sampled; the whole data set is reconstructed afterward. The major drawback to parallel acquisition is that SNR is diminished, and this represents a fundamental challenge as acceleration factors are increased. Among the strategies to counteract the SNR loss of parallel imaging are the use of stronger magnetic fields and improvement and adjustment of array coil geometry and sensitivity. The recently-introduced Trio with Tim system has the potential to improve CEMRA applications by providing a firm base to support aggressive acceleration factors.

The integrated multicoil arrays have better sensitivity profiles for parallel acquisition than those available previously, with the promise of increased CEMRA performance in a 32-channel receiv-

# Q&A with Dieter Enzmann, MD

Just more than one year ago, the University of California Los Angeles Medical Center's department of radiology acquired a 3T Trio MR from Siemens. To discover what the university has accomplished with it since then, *Decisions in Imaging Economics* interviewed Department Chairman Dieter Enzmann, MD.

**Imaging Economics:** Has the introduction of 3T impacted practice patterns at UCLA?

**Enzmann:** Allow me to clarify up front that our 3T machine is at this juncture used only for research and not for clinical purposes. There is clear evidence that 3T offers a higher signal-to-noise (SNR) ratio. However, because there are magnetic susceptibility effects with 3T, modifications are necessary in the pulse sequences to take advantage of the increased signal-to-noise ratio. Our research is attempting to determine how best to adapt the pulse sequences, contrast injection, and various other parameters. We are evaluating whether new approaches to RF and coil design would be helpful. With regard to your question, we are also exploring at what point the SNR becomes a key determinant of image quality and whether that will make a clinical difference. Much of this has already been shown for neuro applications; our research is primarily geared to see how well 3T works in cardiac imaging and vascular imaging.

**Imaging Economics:** Within your department, has the introduction of 3T resulted in rethinking the diagnostic imaging protocols for any particular disease states or conditions?

**Enzmann:** We are finding image quality with 3T is much improved compared to 1.5T, and that is perhaps most evident in MR angiograms where we are able to obtain never-before-seen vessel detail. As a result, when high-end angiography is called for, when we really need to have an accurate rendition of small vessels, we are now convinced that patients should if possible be steered to 3T.

**Imaging Economics:** Are there any circumstances in which cardiac MRA should displace catheterization?

**Enzmann:** It has already replaced a lot of what I will call conventional diagnostic angiograms; 3T will probably complete the progression.

**Imaging Economics:** Faster scan times are reportedly possible with 3T. What are the economic implications of such speed?

**Enzmann:** It potentially means improved throughput, but by how much will depend on multiple factors, including patient handling. This is an aspect we have yet to investigate.

**Imaging Economics:** How is your radiology department handling the rollout of 3T?

**Enzmann:** It's a slow, methodical process. We test a new protocol, and then, if it looks like it might be of clinical benefit, we offer it to patients. As we began to move out of the research stage, the first clinical uses were in cardiovascular applications. Right now, we are continuing to develop and evaluate new pulse sequences, and we recently installed a new set of coils for testing [as part of the Tim upgrade, Siemens matrix coils were recently delivered to UCLA]. We are constructing two new hospitals, and each will have access to at least one 3T machine – how rapidly that occurs will depend on how soon those new buildings are completed.

**Imaging Economics:** Are there any obvious turf implications associated with the greater field strength?

**Enzmann:** [wryly] Nothing that wasn't there already with 1.5T.

*—R. Smith*

er chain. Multiple arrays of RF receiver coils, with associated multiple RF receiver-channel electronics, combine for more effective parallel acquisition strategies. The appropriate use of parallel acquisition can result in improved CEMRA performance to increase coverage, speed, or spatial resolution, in any combination.

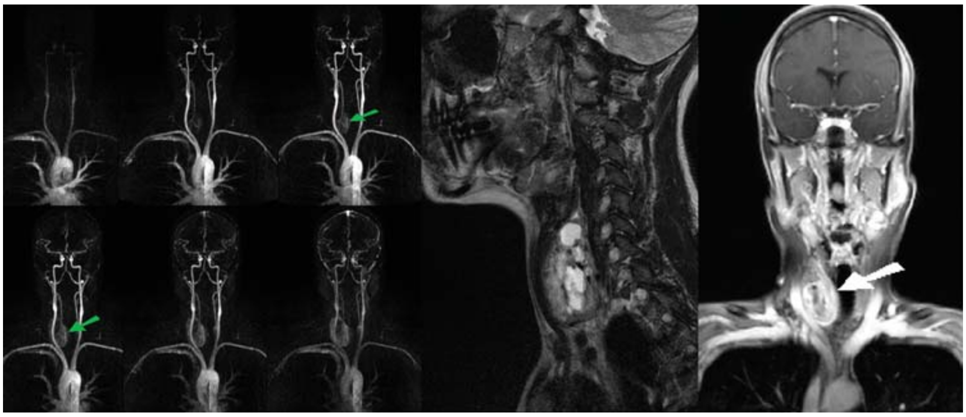

***Figure 2.*** *Coronal maximum-intensity projection from time-resolved contrast-enhanced MR angiography shows early arterial enhancement of the right thyroid lobe (data were acquired with in-plane resolution of 1x1 mm and temporal resolution of 1 second, after injection of only 5 mL intravenous contrast). Coronal turbo spin echo and postcontrast images using longitudinal relaxation time fat suppression through presaturation show nodular enlargement of the right thyroid lobe.*

## CLINICAL APPLICATIONS

3D CEMRA has been established as the method of choice in evaluation of the craniocervical vasculature for a variety of conditions (including atherosclerotic arterial disease, aneurysms, and arteriovenous malformations) and for the presurgical assessment of tumors. At UCLA Medical Center, we have used both time-resolved and high–spatial-resolution techniques for craniocervical CEMRA. Figures 1 and 2 show examples of head and neck CEMRA acquired using the Trio with Tim system.

Clinical applications in the pulmonary circulation include evaluation of pulmonary embolism, pulmonary hypertension, and congenital heart disease, along with pulmonary venous mapping. In the abdominal vasculature, clinical applications are assessment of atherosclerotic arterial disease, aneurysms, and aortic dissection; preoperational assessment of tumors; and evaluation of abdominal veins. In our practice, MR venography is a rapidly growing application.

***Figure 3.*** *Coronal maximum-intensity projection images from four-station whole-body contrast-enhanced MR angiography at 3T acquired using a Trio with Tim system showing almost the entire vascular tree with submillimeter voxel size. The data were acquired in four separate image-acquisition steps following separate two-step contrast-injection phases.*

At 3T, multistation whole-body CEMRA can be performed with high–spatial-resolution data sets (submillimeter voxels). By integrating parallel imaging, an appropriate contrast-injection protocol, and flexible table movement, venous contamination can be minimized or avoided. The procedure is feasible and convenient for both patient and technologist, eliminating the need for coils or patient repositioning. Figure 3 shows an example of whole-body MRA acquired using the Trio with Tim system.

## SUMMARY

A wide spectrum of vascular disease processes can be depicted using 3D CEMRA at 3T. Our experience, to date, suggests that CEMRA at 3T is robust and frequently yields spectacular images using lower contrast doses than are typical at 1.5T. We now use 3T routinely for CEMRA of the carotids, thorax, abdomen, and pelvis, and have found, so far, that patient acceptance is similar at 1.5T and 3T.

It is still too soon to comment definitively on patient outcomes because experience is far more limited at 3T than at 1.5T. To date, however, we know of no cases at our institution in which CEMRA at 3T has provided misleading or false information. We also know of many cases in which vascular findings, evaluated in very fine detail, were confirmed by conventional angiography or during surgery.

It is also too early to comment on cost-benefit issues at 3T. There is no link between field strength and reimbursement level; unless this changes, it will remain more expensive to run a service at 3T than at 1.5T.

*Kambiz Nael, MD, is radiologist; Gerhard Laub, PhD, is physicist; and J. Paul Finn, MD, is professor of radiology and medicine, chief, diagnostic cardiovascular imaging, and director, magnetic resonance research, Department of Radiology, University of California, Los Angeles, Medical Center.*

# A Competitive Edge

By Rich Smith

As competition among imaging centers intensifies, providers seek technology that gives them an edge. David A. Siker, MD, managing partner of Siker Medical Imaging and Intervention, Portland, Ore, found just such an advantage in the form of 3T. "The best way to compete is to offer the best imaging studies possible, and that's precisely what a 3T magnet delivers," Siker says.

> Siker Medical Imaging and Intervention in Portland, Ore, is one of the first freestanding imaging centers in the nation to add 3T MR for clinical purposes.

It was the desire to produce studies of the highest quality that led Siker, in 2005, to acquire a Siemens Trio with Total imaging matrix (Tim), making Siker Medical Imaging and Intervention first in the United States among freestanding centers to install the 3T system for clinical (as opposed to research) applications.

Siker reports that this purchase will do much to ensure the viability of his enterprise, which launched only a short time ago (in May 2005) and will not complete passage through its period of most pronounced business risk for at least another year.

## RECIPE FOR SUCCESS

The Trio with Tim system is Siker Medical Imaging and Intervention's main modality (a C-arm is used in conjunction with it, and the center will soon add a 64-detector CT scanner). Five neurosurgeons are part of the venture, but Siker is the sole physician physically based at the center. Three crosstown subspecialty radiologists provide backup reads via a T1 line. Siker's work environment, however, is unlike those of his associates. The center, set near Portland's historic Pearl district, occupies a century-old, $372\text{-m}^2$, factory-style building that once housed a production bakery. "I did not like any of the conventional medical office spaces that the real estate agents kept showing me," Siker explains, noting that those offerings lacked authenticity, a characteristic that many Portlanders cherish.

Siker renovated the former bakery (with its rectangular concrete slab foundation that proved ideal to support an MRI unit), but left intact many of the cavernous building's endearing features (such as the overhead exposed ductwork and long rows of windows) while adding some stylish touches of his own (such as aged pine flooring). "It has a different ambiance. Patients think that it is really cool, and that contributes to putting them at ease when they come in, so they feel more comfortable during imaging studies and procedures," Siker says. "The MRI room itself was especially built with the claustrophobic patient in mind. It is unusually large; it has windows, wooden floors, and potted plants. It is a very nonthreatening space."

*David A. Siker, MD*

Siker settled on the Siemens Trio after a careful evaluation of available technology. "It was clearly a genuine workhorse of a system, the best of any that I had seen," he says. "As a neurointerventional radiologist who performs high-end specialized procedures of the neck and head, I have always been one to push the technology envelope in the clinical setting. This venture is no different. The business plan that I developed spelled out that we would be equipped with state-of-the-art MRI because I wanted the absolute best imaging possible. That made Siemens' new 3T magnet the obvious—and easy—choice for me."

## COVERAGE AND THROUGHPUT

Siker's due-diligence efforts took him to several sites where Trio was installed, but without Tim. At one of those, he noticed, alongside the Trio system, another relatively new Siemens MRI product, the Avanto (a 1.5T magnet). This particular unit was outfitted with Tim technology. Siker observed Tim in action and thought it remarkable. "I was very impressed by the image production speed and coverage—quite superb," he says. Siker had reservations about buying Trio without Tim because, despite the stellar quality of Trio's images, he was less than fully satisfied with regard to coverage. He indicated, though, that he would buy Trio immediately if Tim could be packaged with it. Siemens responded with the news that it was soon to release a version of Tim expressly for Trio. "The addition of Tim to Trio amounted to a huge transformation of the magnet's capabilities, in my estimation," Siker says. "It provided much greater coverage, for one thing. For another, it provided much greater throughput. You can place a patient in the system and scan the brain and thoracic, cervical, and lumbar spine without having to reposition once."

Trio with Tim contributes directly to superior clinical quality at Siker Medical Imaging and Intervention, but it contributes indirectly as well. "3T requires a bit more fine-tuning than lower-powered units, and that calls for technologists who really know their MRI physics," Siker says, adding that the necessity of having those highly skilled technologists on staff serves to enhance clinical quality further in the broadest sense, not solely with regard to MRI operation.

Siker's Trio with Tim is interfaced with the center's picture archiving and communications system (PACS) and radiology information system (RIS). Siker avoided the high cost of buying information technology by creating a robust RIS of his own from inexpensive, off-the-shelf software (although it should be noted that, prior to becoming a radiologist, Siker was an electrical engineer whose job involved software design). Then, he bought a plain-vanilla web-based PACS at a cost of merely $60,000, a fraction of what he could have spent otherwise.

"For a small, start-up imaging center like ours, where every dollar counts, this approach was invaluable," he says. "Because our informatics outlays were so small, we had a lot more money available to invest in the very finest MRI system possible. That was important because Trio with Tim is key to our business strategy and to giving us the ability to be a strong competitor."

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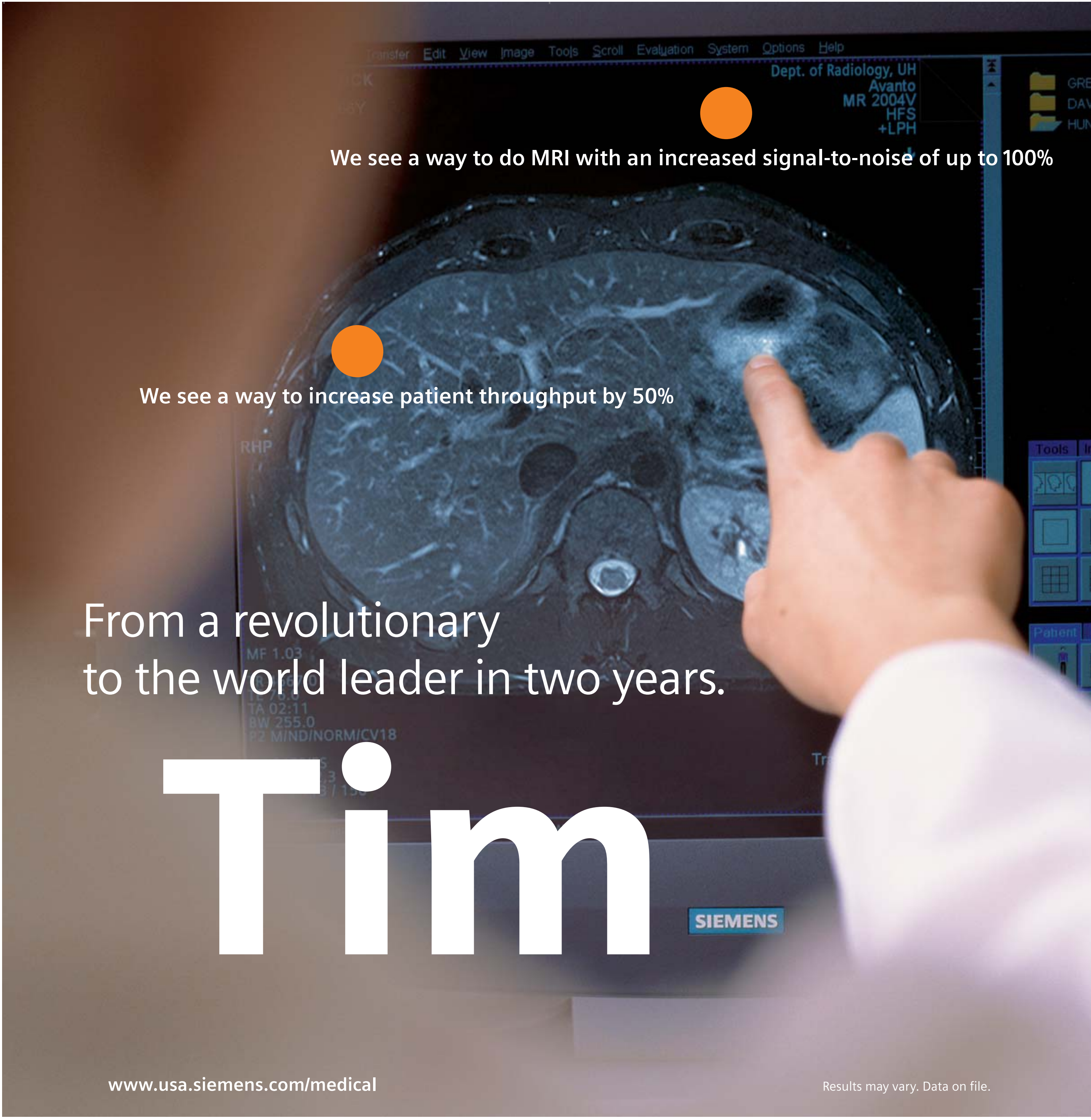
*Rich Smith is a contributing writer for* Decisions in Imaging Economics.

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