



# Using an efficient, quantitative sequence to aid in patient treatment decisions

As part of the University of Chicago Medicine health system, the six-story, 525,000-square-foot Duchossois Center for Advanced Medicine (DCAM) is an outpatient diagnostic and treatment facility for adults, both primary and specialty care, and pediatric specialty care. Of the center's three GE Healthcare MR scanners, one was a nearly 17-year-old SIGNA™ HDxt 1.5T. Recently, it was upgraded to a SIGNA™ Explorer as part of GE Healthcare's SIGNA™

Lift program. A key advantage of the upgrade is the center now has access to many of GE Healthcare's advanced technologies and sequences, like the multi-contrast MR technique, MAGnetic resonance image Compilation (MAGiC). With MAGiC, a single scan generates multiple image contrasts including T1, T2, Inversion Recovery (e.g., T1 FLAIR, T2 FLAIR, STIR, PSIR and DIR), and PD contrasts of the brain.

John Collins, MD, PhD, Assistant Professor of Radiology, University of Chicago Medicine, is a neuroradiologist at University of Chicago. He had the opportunity to utilize MAGiC to image Multiple Sclerosis (MS) patients. Dr. Collins and his colleagues have developed specific protocols for patients based on their pathology and disease. In many cases, the protocols include additional sequences, as the

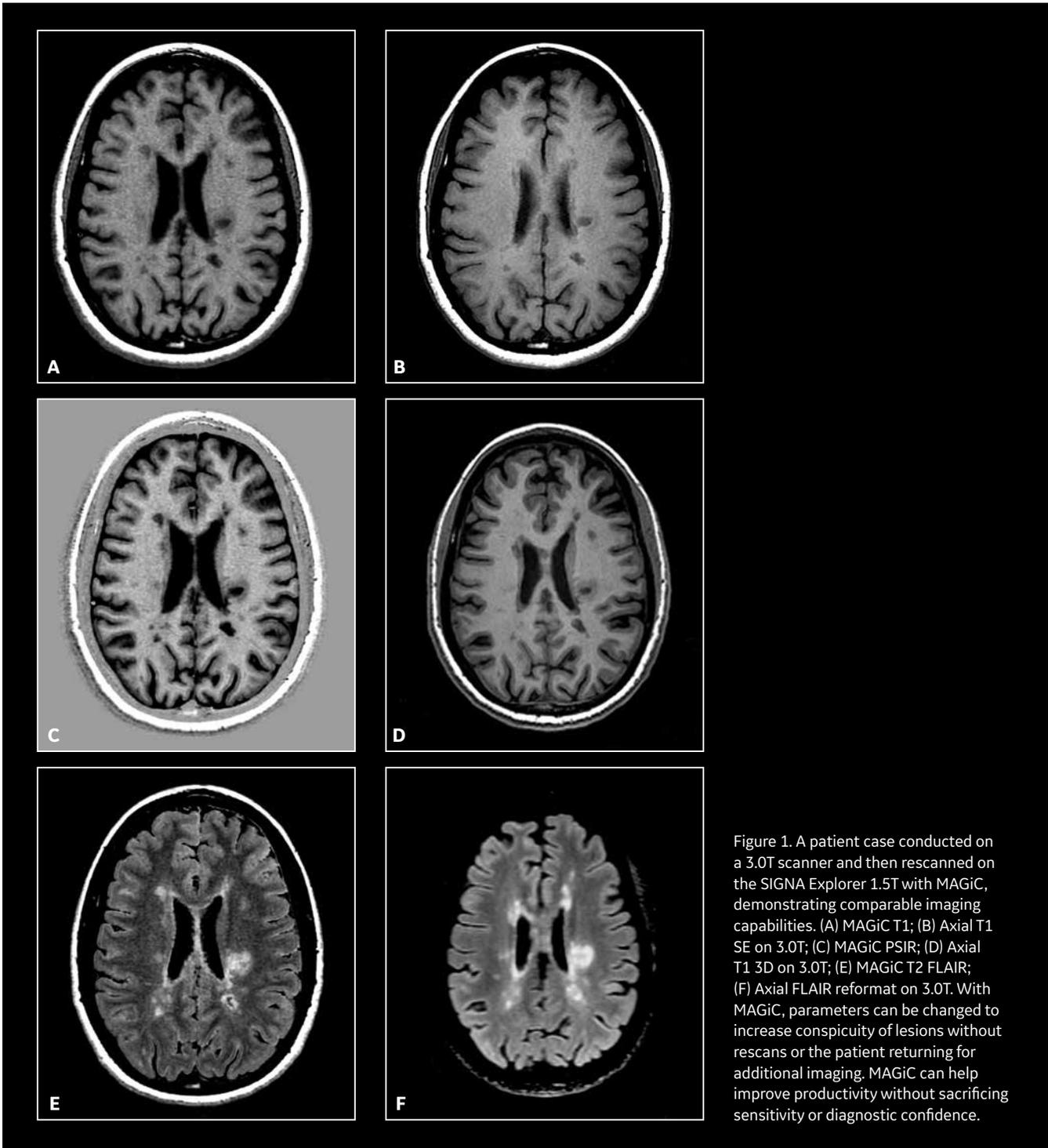


Figure 1. A patient case conducted on a 3.0T scanner and then rescanned on the SIGNA Explorer 1.5T with MAGiC, demonstrating comparable imaging capabilities. (A) MAGiC T1; (B) Axial T1 SE on 3.0T; (C) MAGiC PSIR; (D) Axial T1 3D on 3.0T; (E) MAGiC T2 FLAIR; (F) Axial FLAIR reformat on 3.0T. With MAGiC, parameters can be changed to increase conspicuity of lesions without rescans or the patient returning for additional imaging. MAGiC can help improve productivity without sacrificing sensitivity or diagnostic confidence.

goal is to obtain as much information on the patient as possible: time on the scanner is not a key concern.

For the MS patients who undergo a neuro MR exam, the primary benefit of MAGiC for these patients is the sequence's T1 and T2 mapping capabilities. Dr. Collins finds the T1

and T2 mapping capabilities to be a valuable addendum to the patient's neuroimaging evaluation.

**“We’re using the T1 and T2 mapping capabilities to look for changes in the MS lesions resulting from therapy that we can’t otherwise image with conventional sequences.”**

*Dr. John Collins*

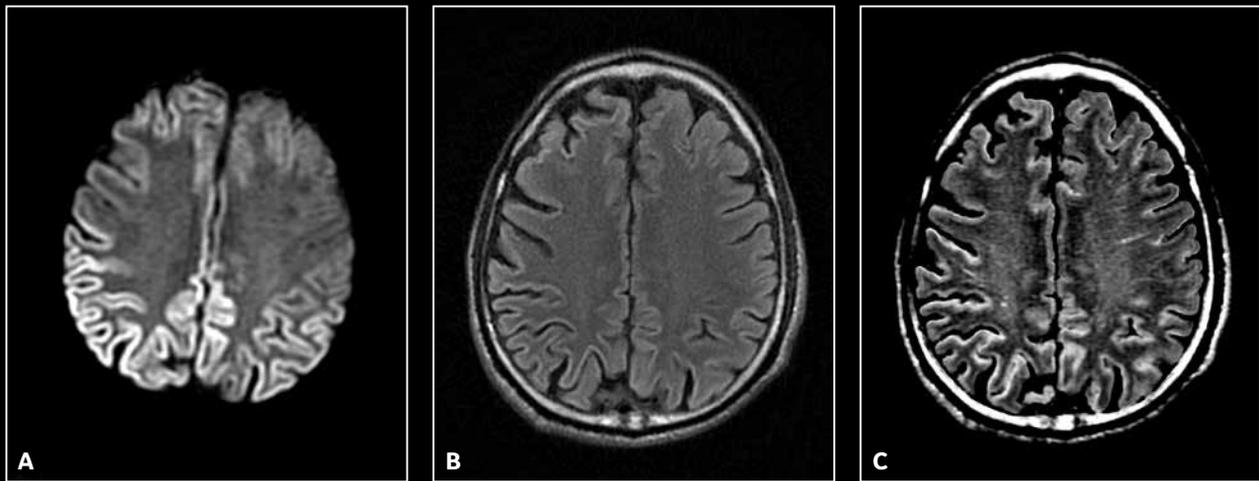


Figure 2. This patient exam shows a large area of restricted diffusion posteriorly in both lobes of the brain. The normal T2 FLAIR isn't sensitive enough to confirm this but MAGiC provided a higher sensitivity that enabled the clinician to confirm this was a real finding.

Dr. Collins finds the T1 and T2 maps can be more sensitive than conventional T2 or FLAIR sequences.

The process involves marking the regions of interest in the lesions, tabulating the T1 and T2 values and then following the patient over time to see if the values correlate with the progress of the disease—and if the patient is responding to therapy.

“Are there imaging characteristics that we can use to predict whether a person will respond to therapy?” Dr. Collins asks. That’s the key question he is hoping MAGiC with T1 and T2 mapping capabilities can help him answer.

While still too early to share any definitive results, Dr. Collins does see the value of MAGiC for his study.

“Lesion conspicuity is definitely enhanced with parametric T1, T2, R1, R2 and PD maps for our further analysis of MR acquisition data,” he adds.

With MAGiC, Dr. Collins can set specific parameters for T2 and FLAIR imaging, including additional image contrasts. For each disease process—whether it be for an MS or oncology patient—he can optimize these settings.

For example, the parameters for T2 of the brain are the same for most conditions—infection, MS, suspected stroke and tumors. However, there may be a situation when he wants a more sensitive evaluation, such that even the subtlest lesions might be visualized in an MS patient.

“Being able to see one or two tiny lesions can mean the start or change of therapy in an MS patient,” he explains. “There are other situations where I don’t want that level of detail.”

While with conventional sequences only one contrast is acquired at the scanner, with MAGiC a range of contrasts can be potentially processed. The optimal contrast for an MS patient may not be the same for a head and neck cancer patient.

“This provides the potential to rethink how we scan patients,” Dr. Collins adds. “That’s not a new idea, we do this with CT imaging right now with different settings for soft tissue such as lungs, or different window leveling for the liver, kidney or bowels. It is intuitive that we can benefit in MR from this same approach. We could repeat sequences, but clinically that is not efficient. However, with MAGiC we can generate different contrasts, such as T2 or Proton Density, after the scan.”

Once the settings within MAGiC are established, Dr. Collins says that generating different contrasts does not take a lot of additional time. There is a learning curve, but the benefits are clear to him.

“If we can see more lesions or get a truer sense of the lesion size, then I think this will catch on because it could change patient management,” he adds.

While scanner time is not an issue at DCAM, there is the potential for sites to achieve scan time savings by using

MAGiC. This could be particularly useful in pediatric patients. In this patient group, Dr. Collins sees the potential to perform a diffusion-weighted sequence and then use MAGiC to generate additional contrasts. By reducing sequences, scan time could be dramatically shortened which could lead to fewer pediatric patients being sedated for an MR exam.

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**“We could almost obtain a complete brain MR in 10 minutes and that is not possible with conventional sequences. This is a new technology that we really need to step back and re-examine how we image with MR. We should not limit it to just a few pathologies. With the customized contrast levels, MAGiC could be helpful for a variety of conditions.”**

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*Dr. John Collins*

Head and neck tumors are another condition where MAGiC may be helpful. Daniel Ginat, MD, Assistant Professor of Radiology, University of Chicago Medicine, is interested in using MAGiC to optimize MR protocols for these types of patients.

“The literature suggests that lesions are more conspicuous on the T1 sequences,” Dr. Ginat explains.<sup>1-4</sup>

“But these sequences also tend to be noisier, so it would be an advantage to optimize our T1 protocol for head and neck applications.”

Currently at DCAM, additional sequences beyond T1 are acquired for these patients. However, shortening the scan time by post processing additional contrasts with MAGiC could help reduce motion artifacts. Dr. Ginat explains that by the end of a long scan, patients may become irritable and move.

“If we can run a 5-minute scan to get 15 minutes worth of MR imaging data, then it might lead to fewer motion artifacts and incomplete exams. Ultimately, shorter scan times are better for the patients and increase throughput for radiology departments,” he says.

While his experience with MAGiC is currently limited, Dr. Ginat did have one case where a lesion was more conspicuous on the MAGiC post-processed FLAIR than on the conventionally acquired FLAIR scan.

“T1 mapping may be useful to provide an assessment of lesions,” Dr. Ginat explains.

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**“I believe there are some important advantages of using MAGiC to characterize abnormalities in the head and neck, but further research is needed.”**

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*Dr. Daniel Ginat*

Both Dr. Collins and Dr. Ginat hope to continue exploring MAGiC and the impact it may have on managing MS and head and neck cancer patients. **S**

#### References

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