

# Two-minute MR ultra-fast neuro protocol

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SIGNA™ Architect

MR imaging can be utilized for differentiating healthy versus damaged brain tissue in suspected stroke patients even though MR imaging is still challenging due to long scan times. MR has been demonstrated to be more sensitive for lesion detection and more specific for delineation of healthy versus damaged brain tissue compared with CT in patients with acute ischemic stroke.<sup>1-4</sup> However, there is a need for further improvements in MR acquisition speed and limited availability.

The phrase “time is brain” emphasizes that brain tissue is rapidly destroyed as ischemic stroke progresses, so

rapid evaluation with prompt therapy is very important.

Therefore, the practicalities of using MR for imaging brain tissue as one tool in the diagnostic work up for suspected acute stroke patients, especially in restless and uncooperative patients, remains challenging even for major academic institutions.

In this patient case, there is a strong suspicion of acute ischemic stroke. The patient also had end-stage kidney disease and showed a severe degree of irritability during the physical examination. Therefore, there were

Image Parameter	Ultra-fast T1	Ultra-fast T2	Ultra-fast FLAIR	Ultra-fast DWI	Ultra-fast T2*	Ultra-fast MRA
Sequence:	T1 SPGR	T2 SSFSE	T2 FLAIR EPI	SE EPI	T2* Gradient	3D TOF SPGR
FOV (cm):	24	24	24	24	24	20
Phase FOV (cm):	0.75(18)	1(21.6)	0.9(21.6)	0.9(21.6)	1	1.84(16.8)
Slice thickness (mm):	5	5	5	5	5	1.6
TR (ms):	167.7	392.7 min	10000	2511(auto)	1600	27
TI (ms):			2200			
TE (ms):	2.6	102	100	74.9	22.2	2.6
ETL (ms):						
Frequency matrix (mXn):	260	320	128	128	128	320
Phase matrix (mXn):	190	320	256	128	320	160
Bandwidth (kHz):	31.25	83.33	250	250	250	35.71
ASSET/ARC factor:	ARC 2	ASSET 3		ARC 2	ASSET 3	ARC 2, HS 2
Imaging options:	FC, EDR	EDR, TRF		EDR, HB	FC	FC, EDR, ZIP2, ZIP512, FS
Scan time (sec):	15	8	25	13	6	38

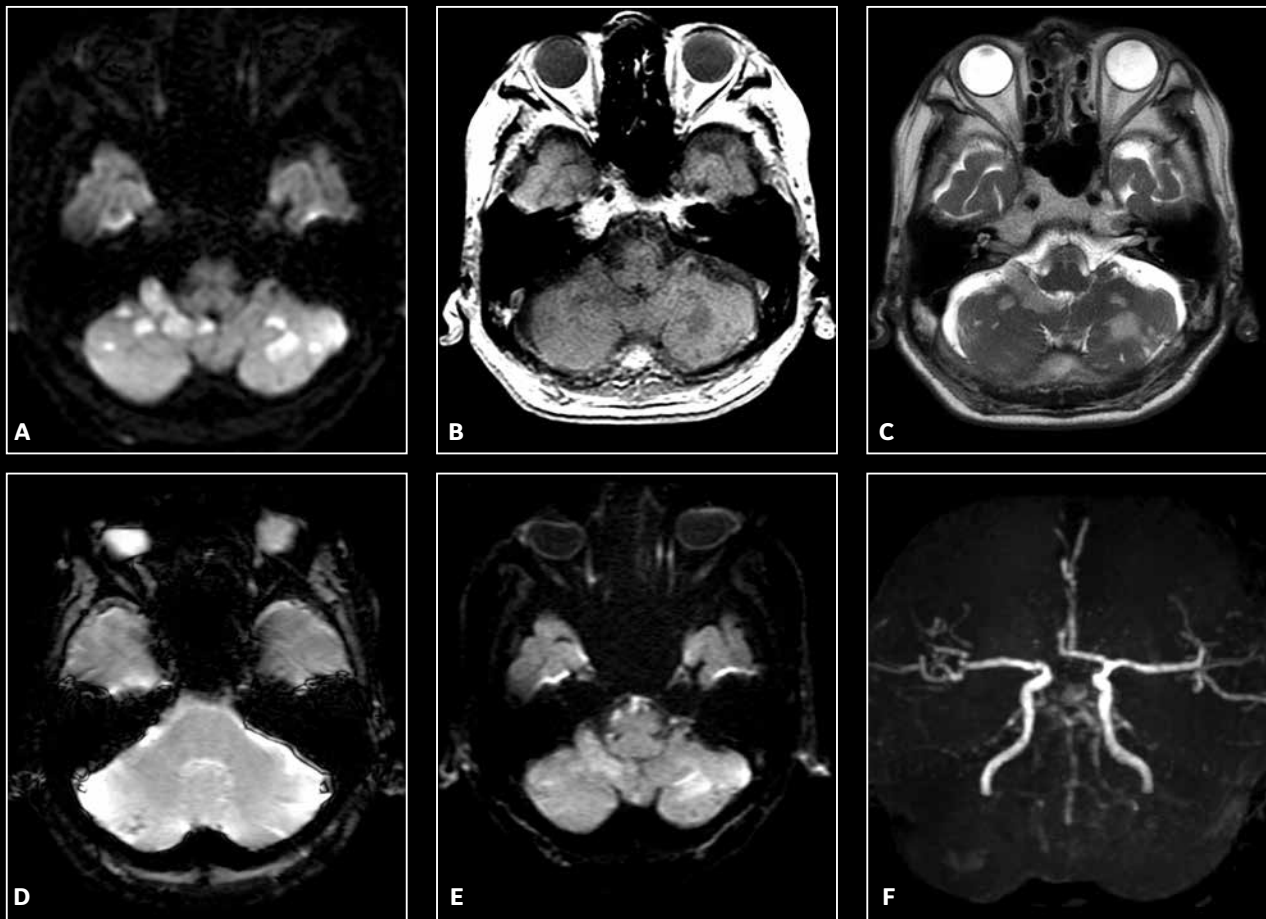


Figure 1. Clinician evaluations of MR images state that there are multiple diffusion restrictions with T1 hypointensity, T2 and FLAIR hyperintensity in both cerebellar hemispheres, suggesting acute infarction. On the GRE image, clinicians state that there are faint hemorrhages in both posterior cerebellar hemispheres, suggesting hemorrhagic transformation. On the MRA image, clinicians state that there are a few apparent focal stenoses seen in the basilar arteries.<sup>5</sup>

physiological difficulties in performing a neuroimaging study.

Using HyperSense and HyperBand from the SIGNA™ Works productivity platform, we performed a 2-minute ultra-fast neuro protocol MR exam.

### Patient history

An 83-year-old patient, weighing 128 lbs (58 kg) and 5 feet 4 inches (164 cm) tall, with underlying disease (hypertension, end-stage kidney disease and diabetes mellitus) with sudden onset of dysarthria and vertigo.

### MR findings

MR images showed multiple hyperintense lesions on diffusion-

weighted images and FLAIR with coexisting hemorrhages in both cerebellar hemispheres. With this imaging data, we were able to identify acute embolic infarctions due to cytotoxic edema and distribution of the lesions. We also found a few apparent stenoses in the basilar artery with underlying hypoplasia due to fetal variant of both posterior cerebral arteries. On the initial neurologic examination, NIHSS was 7 points (dysarthria 2 points, ataxia 2 points, facial palsy 2 points and sensory change 1 point). Atrial fibrillation was confirmed during hospitalization, causing cerebellar infarctions.

### Discussion

Using HyperSense and HyperBand on the SIGNA™ Architect, we acquired valuable images which aided in determining patient diagnosis and management without the use of contrast media or concern for motion artifacts and scanning time (Figure 1).

Imaging data helped to confirm our initial neurologic diagnosis by depicting a conspicuous delineation of the lesions despite the patient's uncooperative state. We also performed an ultra-fast MRA to image major intracranial arteries in a very short scan time. In this case, our evaluation of the MR images enabled us to achieve an appropriate course for patient management.

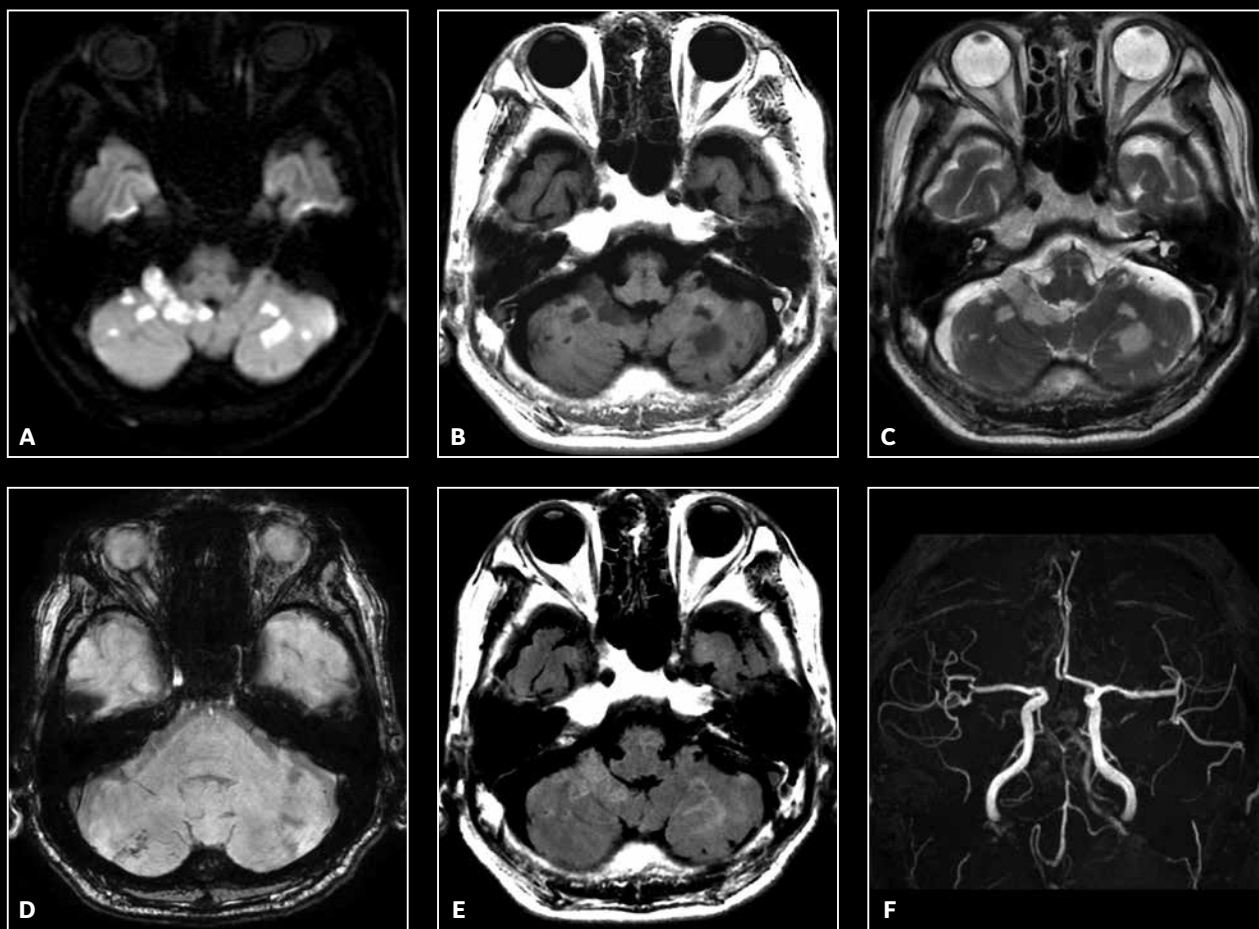


Figure 2. MR images generated using MAGiC on the two-day follow-up. Clinicians determined that multi-focal acute cerebellar infarctions do not indicate significant interval change and demonstrate good correlation with initial ultra-fast MR.<sup>5</sup>

This case suggests that our 2-minute ultra-fast neuro protocol using HyperBand and HyperSense can be a useful imaging tool in patients with presumed acute ischemic stroke and provide an added benefit in patients who are unable to endure longer acquisition times or are contraindicated for contrast. In this case, using this protocol aided in our rapid diagnosis that assisted with patient management decisions.

Additionally, we performed a two-day follow-up MR using MAGnetic resonance imaging Compilation (MAGiC) in this patient, providing an interesting comparison of two different fast imaging protocols (Figure 2). Our clinicians were already familiar with fast imaging using MAGiC as a routine

neuroimaging protocol in our institution. Therefore, it was not difficult to implement a 2-minute ultra-fast neuro protocol as other challenging fast MR protocols exist in our clinical practice.

Now we have more than 30 clinical cases utilizing our 2-minute ultra-fast neuro protocol. Our clinicians are satisfied with this protocol due to its shorter scan time, acceptable image quality and diagnostic capability. Although the image quality is perceived as slightly inferior to that of a routine 20-minute protocol with MAGiC, the use of a 2-minute ultra-fast neuro protocol is feasible to visualize brain tissue, which aids in our evaluation of time-critical diseases like stroke. In the clinical setting, it has a particular

benefit for the patient who cannot tolerate a longer scan time by reducing motion artifact and minimizing the need for sedation. We believe that these advantages of a 2-minute ultra-fast neuro protocol may extend indications of MR examination into the pediatric, non-cooperative and emergency patients. **S**

#### References

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4. Saur D, Kucinski T, Gryzyska U, et al. Sensitivity and interrater agreement of CT and diffusion-weighted MR imaging in hyperacute stroke. *AJNR Am J Neuroradiol* 2003;24:878-885Ab.
5. The figures in this article will be used in future journal publications, for which the manuscript is in preparation.