

Arterial Spin Labeling (*syngo* ASL) Case Reports from Geneva University

Viallon Magalie, Ph.D.; Karl-Olof Lovblad, M.D., Ph.D.

Hopitaux, Universitaire de Genève, Switzerland

Case 1: Pediatric 1

Patient history

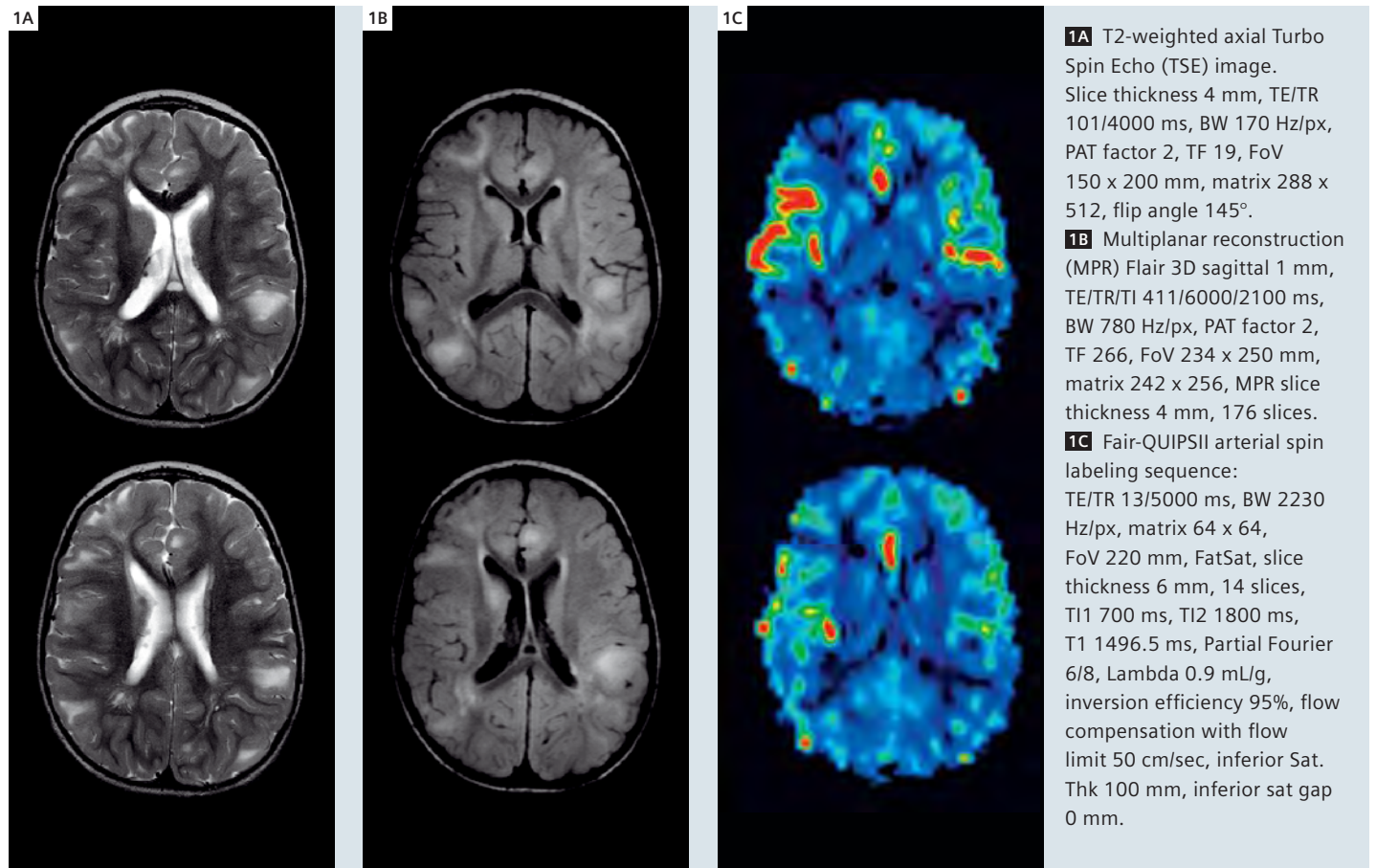
15-year-old female patient with known epilepsy.

Image findings / Results

On the T2-weighted images there are multiple bilateral hemispheric cortical and subcortical hyperintensities that are much more visible on the corresponding FLAIR images. On the ASL perfusion maps we have hypoperfusion in these areas.

Discussion

The multiple cortical and subcortical lesions correspond to tubera in a case of Tuberous Sclerosis of Bourneville.



Case 2: Pediatric 2

Patient history

5-months-old* female with intractable epilepsy with 15 episodes per day.

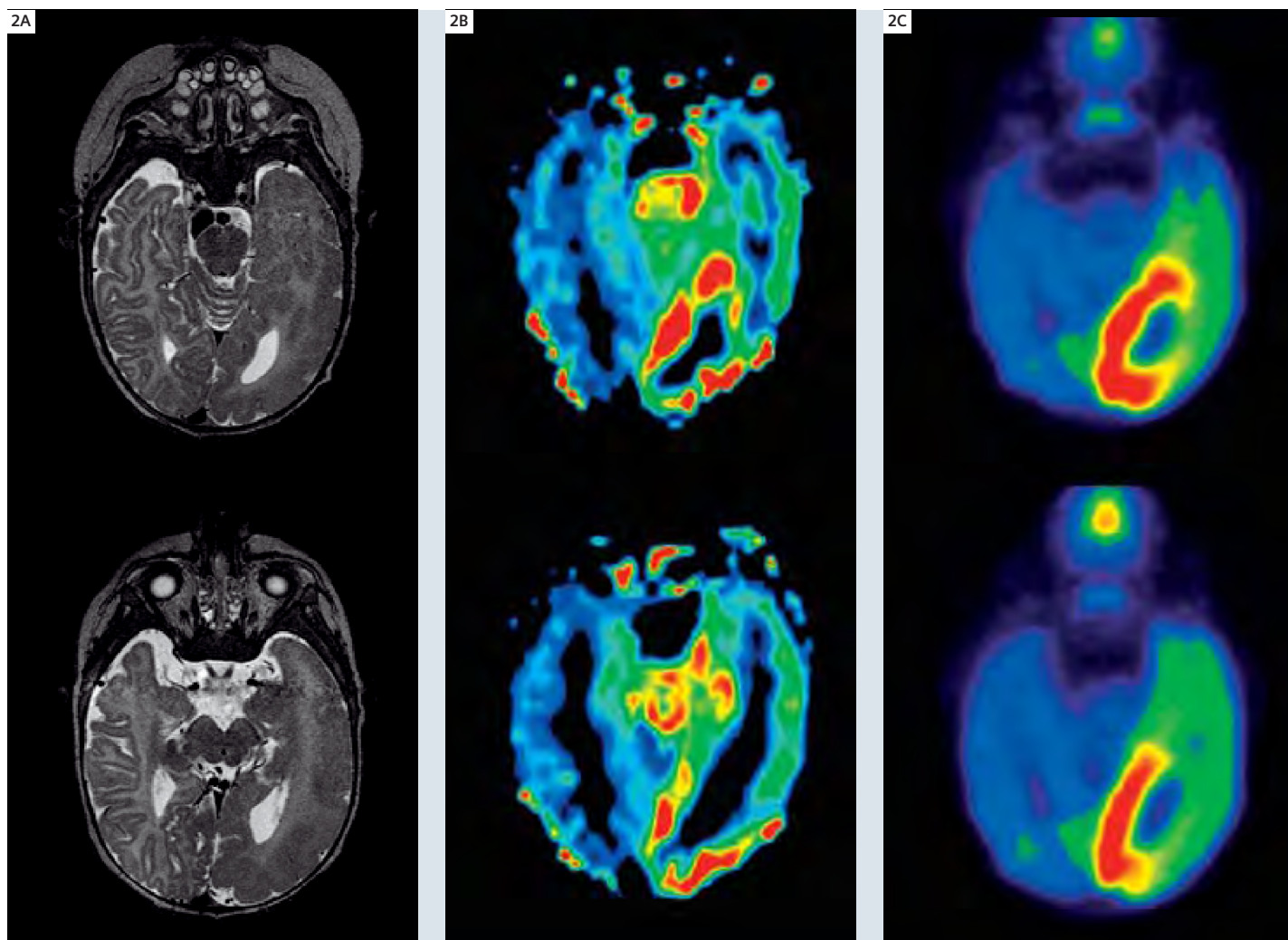
*The safety of imaging infants under two years old has not been established.

Image findings / Results

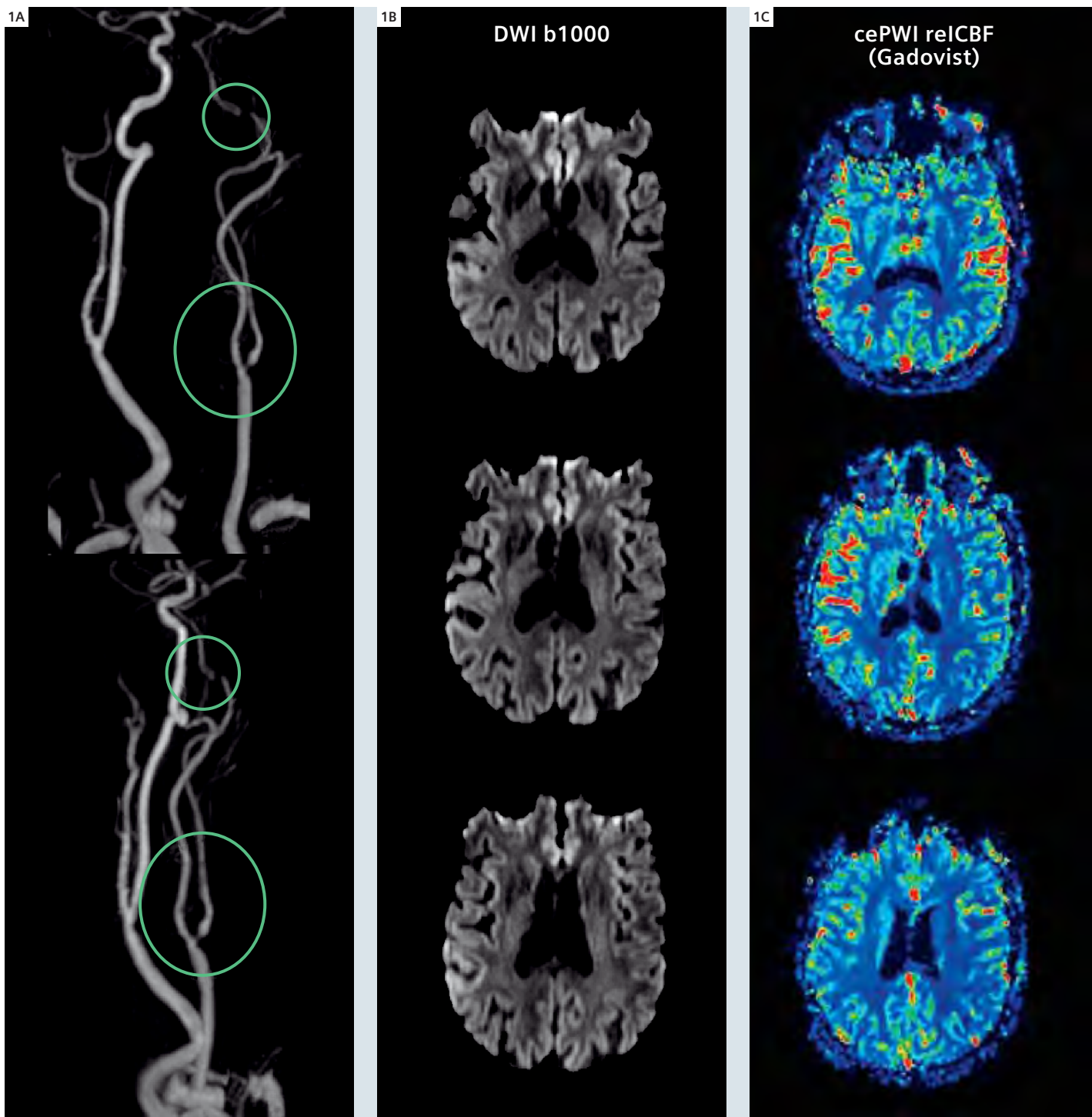
Polymicrogyria of the left hemisphere on the T2-weighted images. On the ASL perfusion maps there is hypoperfusion in the left occipital lobe, which was also seen on FDG-PET (FluoroDeoxyGlucose-Positron Emission Tomography).

Discussion

Left-sided Hemimegalencephaly with polymicrogyria. The ASL data confirm the PET data which shows ictal hyperperfusion in the left occipital lobe.



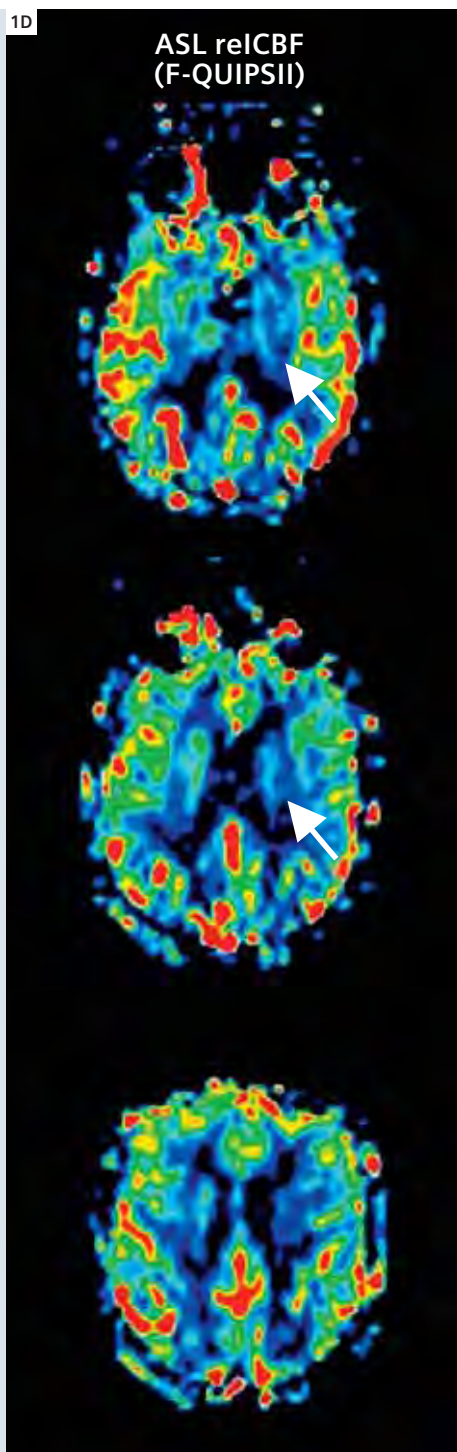
2A T2-weighted axial Turbo Spin Echo (TSE) image, slice thickness mm, TE/TR 101/4000 ms, BW 170 Hz/px, PAT factor 2, TF 19, FoV 150 x 200 mm, matrix 288 x 512, flip angle 145°. **2B** Fair-QUIPSII arterial spin labeling sequence: TE/TR 13/5000 ms, BW 2230 Hz/px, matrix 64 x 64, FoV 220 mm, FatSat, slice thickness 6 mm, 14 slices, T1 700 ms, T2 1800 ms, T1 1496.5, Partial Fourier 6/8, Lambda 0.9 mL/g, inversion efficiency 95%, flow compensation with flow limit 50 cm/sec, inferior Sat. Thk 100 mm, inferior sat gap 0 mm. **2C** F18-FDG PET-CT image with attenuation correction from CT data (Siemens Biograph Sensation 16), 80 MBq, 30 min post injection. These images show glucose metabolism which is linked to perfusion even though not being directly an image of CBF.



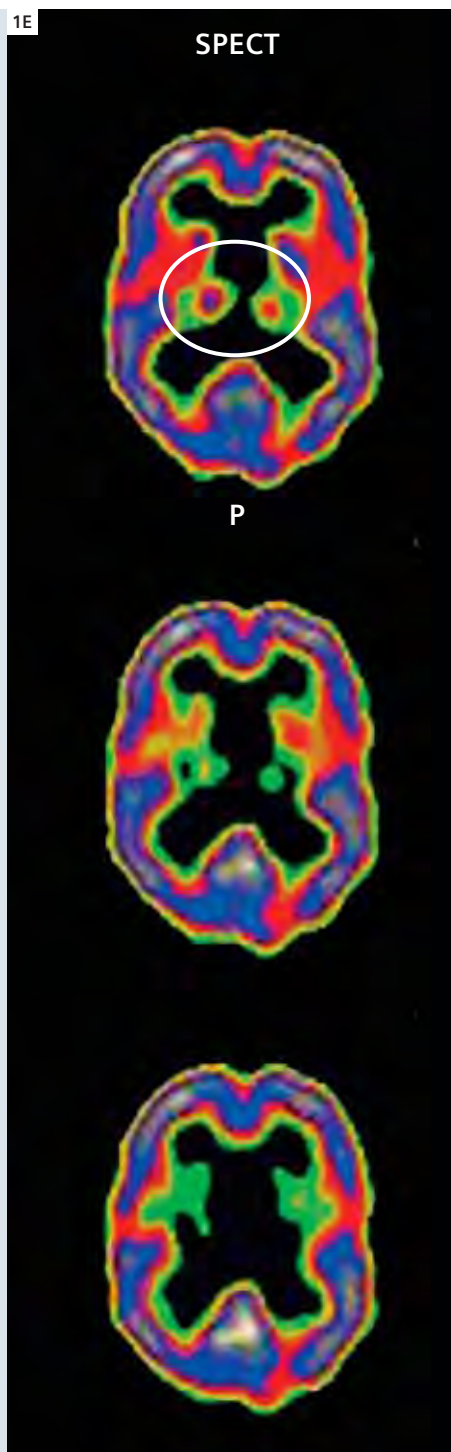
1A Contrast enhanced MR Angiography (ce-MRA): angiogram obtained from Flash3d-ce, voxel 0.8 x 0.8 x 0.8 mm, PAT factor 2, FoV= 263 x 300 mm, matrix 314 x 512, BW 650 Hz/px, flip angle 25°, 88 slices, centric reordering.

1B Diffusion-weighted imaging (DWI) b=1000, slice thickness 4 mm, TE/TR 92/5300 ms, BW 1240 Hz/px, PAT factor 2, FoV 208 x 230 mm, codage AP, matrix 157 x 192, flip angle 90°, 4 averages.

1C Contrast enhanced perfusion-weighted imaging (cePWI)*, relative cerebral blood flow (relCBF)*: relCBF parametric map calculated using syngo MR perfusion*, slice thickness 4 mm, TE/TR 92/4000 ms, BW 1370 Hz/px, PAT factor 2, FoV 200 x 200 mm, matrix 128 x 128, flip angle 90°.



1D Arterial Spin Labeling (ASL) reICBF: Fair-QUIPSII ASL sequence: TE/TR 13/5000 ms, BW 2230 Hz/px, matrix 64 x 64, FoV 220 mm, FatSat, slice thickness 6 mm, 14 slices, T11 700 ms, T12 1800 ms, T1 1496.5 ms, Partial Fourier 6/8, Lambda 0.9 mL/g, inversion efficiency 95%, flow compensation with flow limit 50 cm/sec, inferior Sat. Thk 100 mm, inferior sat gap 0 mm.



1E SPECT acquisition (Toshiba 3-heads) after injection of 369 MBq of 99 mTc-ECD. Post DIAMOX we observe an equalization of the perfusion of both hemisphere, pre DIAMOX, we have an increase perfusion on the right hemisphere.

Case 3: High grade stenosis on the left ICA

Patient history

Patient with left-sided carotid stenosis

Image findings / Results

High-grade left-sided carotid stenosis visible on contrast-enhanced MRA of the carotids. On DWI there are no ischemic lesions. On contrast-enhanced Perfusion* maps there is hypoperfusion in the left basal ganglia and internal capsule, which can be seen both on ASL maps and SPECT.

Discussion

The ASL findings correspond quite well to those identified on both SPECT and contrast-enhanced perfusion in a case of tight carotid stenosis. The enormous advantages of ASL in such a protocol is that it allows to both study perfusion prior to an injection of contrast agent dedicated to ceMRA.

Case 4: Stroke

Patient history

67-year-old male patient with dysphasia and right-sided hemiparesis.

The examination was performed on a MAGNETOM Trio, A Tim system, using a 12-channel head coil.

Image findings / Results

The DWI images show restricted diffusion in the left MCA territory, these changes can be seen on FLAIR and T2. On the ASL there is slight hyperperfusion* due to collateral flow, which cannot be seen on conventional contrast-enhanced perfusion imaging and SPECT images.

Discussion

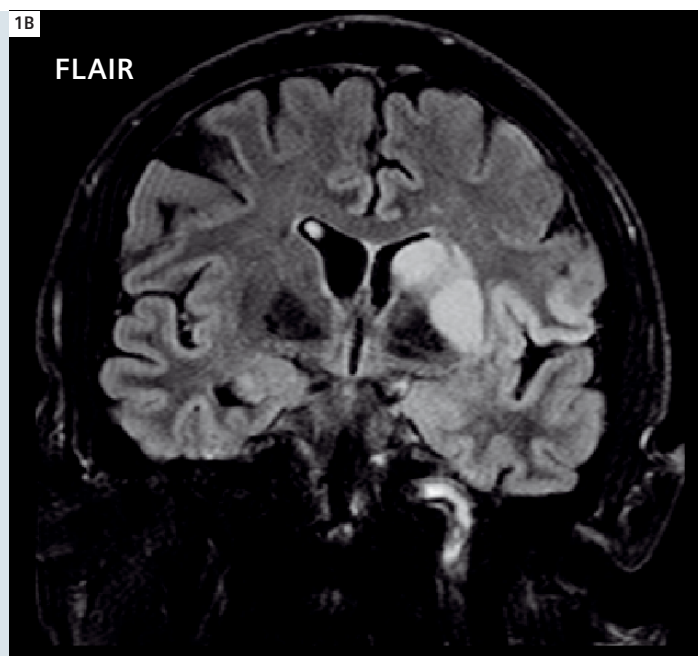
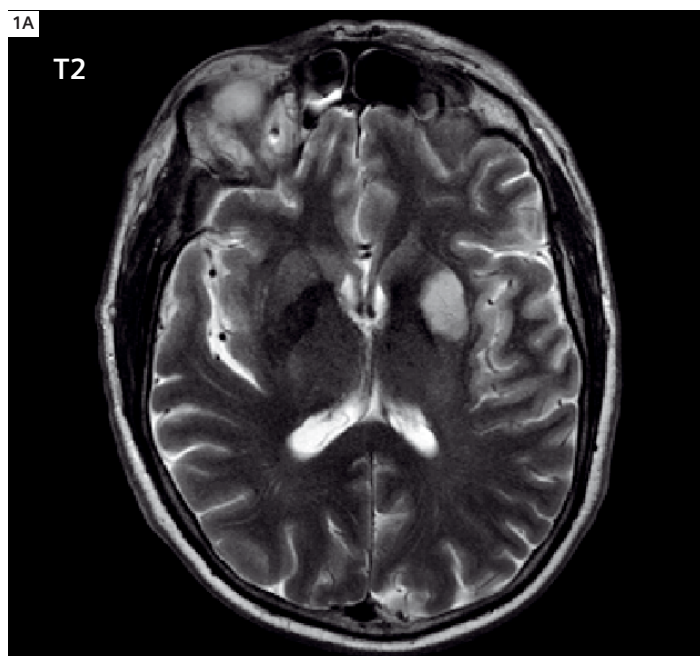
In addition to the diffusion and standard MR sequences, ASL shows reperfusion in acute stroke* that cannot be seen on conventional MR perfusion images. Areas of cortical reperfusion due to collaterals were better assessed by ASL that seems to demonstrate hyperperfusion that might signal recanalization and/or collaterals. Moreover ASL correctly measures CBF even when BBB breaks down, which commonly occurs after a few days in stroke. Thus performing a protocol including ASL may allow one to better include/exclude patients for treatment: impacting on prevention by demonstrating hypoperfusion in carotid stenosis and improving treatment of ischemia by showing hemodynamic compromise.

The examinations were performed on a MAGNETOM Trio, using a 12-channel head coil.

Contact

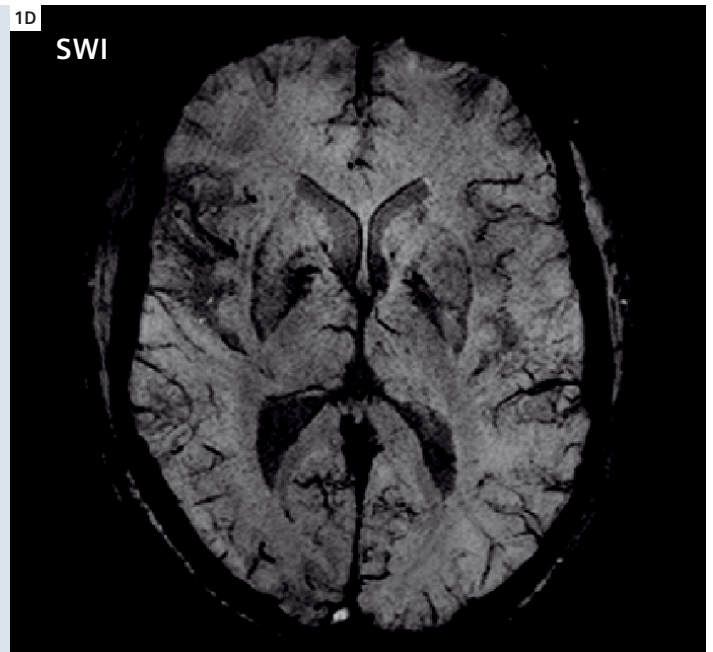
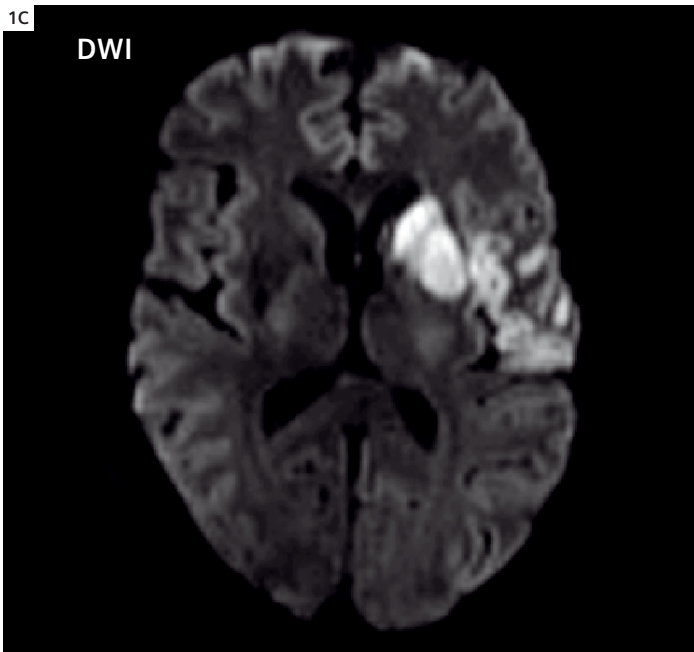
Magalie Viallon, Ph.D.
Hopitaux Universitaire de Genève
Switzerland
Magalie.viallon@hcuge.ch

Karl-Olof Lovblad, M.D., Ph.D.
Hopitaux Universitaire de Genève
Switzerland
Karl-olof.lovblad@hcuge.ch

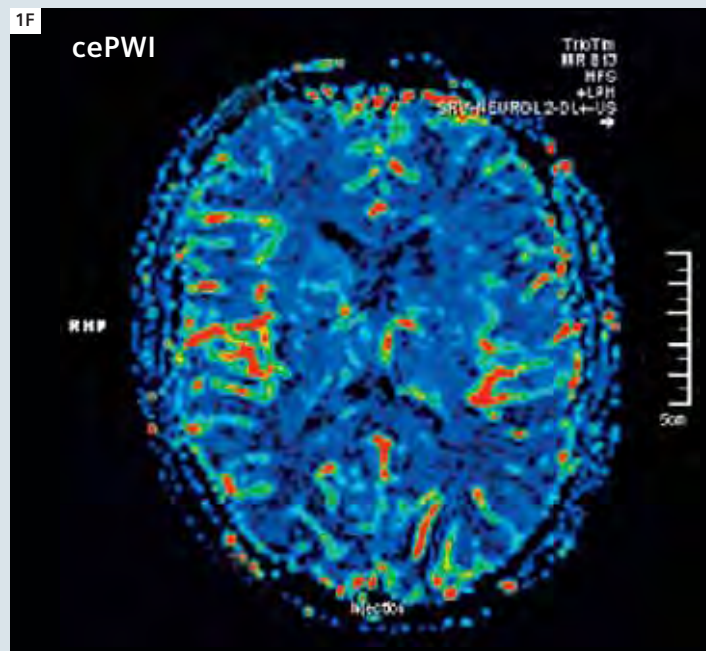
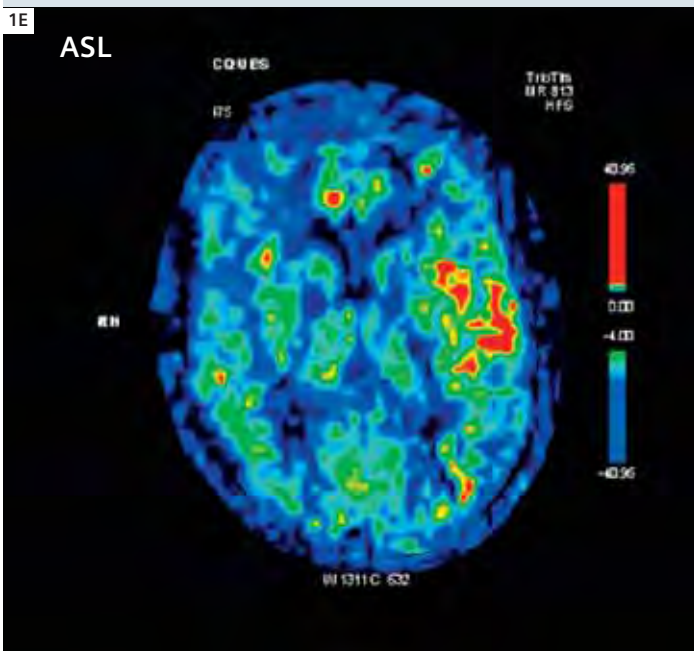


1A T2-weighted axial Turbo Spin Echo image: slice thickness 4 mm, TE/TR 101/4000 ms, BW 170 Hz/px, PAT factor 2, TF 19, FoV 150 x 200 mm, matrix 288 x 512, flip angle 145°. **1B** T2-weighted coronal FLAIR image: slice thickness 4 mm, TE/TR/TI 122/8500/2500 ms, BW 130 Hz/px, PAT factor 2, TF 13, FoV 200 x 230 mm, matrix 190 x 256, flip angle 150°.

*Works in progress (WIP). The information about this product is preliminary. The product is under development and not commercially available in the U.S., and its future availability cannot be ensured.



1C Diffusion-weighted image (DWI): $b=1000$, slice thickness 4 mm, TE/TR 92/5300 ms, BW 1240 Hz/px, PAT factor 2, FoV 208 x 230 mm, codage AP, matrix 157 x 192, flip angle 90°, 4 averages. **1D** Susceptibility-weighted image (SWI): slice thickness 1.2 mm, TE/TR 20/34 ms, BW 110 Hz/px, PAT factor 2, FoV 175 x 200 mm, matrix 224 x 256, flip angle 15°, flow compensation, thin MinIP (minimum intensity projection) axial 8 mm, 60 slices.



1E Arterial Spin Labeling (ASL) reICBF: Fair-QUIPSII arterial spin labeling sequence: TE/TR 13/5000 ms, BW 2230 Hz/px, matrix 64 x 64, FoV 220 mm, FatSat, slice thickness 6 mm, 14 slices, T1 700 ms, T2 1800 ms, T1 1496.5 ms, Partial Fourier 6/8, Lambda 0.9 mL/g, inversion efficiency 95%, flow compensation with flow limit 50 cm/s, inferior Sat. Thk 100 mm, inferior sat gap 0 mm.

1F Contrast enhanced perfusion-weighted image (cePWI)* reICBF: reICBF* parametric map calculated using syngo MR perfusion, slice thickness 4 mm, TE/TR 92/4000 ms, BW 1370 Hz/px, PAT factor 2, FoV 200 x 200 mm, matrix 128 x 128, flip angle 90°.