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Letter to the Editor

Arterial spin-labeling magnetic resonance imaging for diagnosis of early seizure after stroke



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Dear Editor,

Arterial spin-labeling (ASL) is a non-contrast-enhanced sequence of magnetic resonance imaging (MRI) to evaluate cerebral perfusion. ASL has been widely used in cerebrovascular diseases [1]. Previously, we reported the use of ASL for the diagnosis of late seizure after stroke [2]. Here we report a first case of ASL in a patient with early seizure after stroke.

1. Case report

An 85-year-old woman with no past medical history of note presented complaining of sudden dysarthria and right hemiparesis. Brain computed tomography revealed acute hemorrhage in the left putamen (Fig. 1A). She was started on an antihypertensive agent and rehabilitation. On day 9 after onset, she suddenly developed clonic movements of the right face and arm followed by disturbance of consciousness and generalized convulsions. Although T2*-weighted brain MRI (repetition time (TR) = 520 ms and echo time (TE) = 18 ms) performed 1 h after the seizure showed no interval changes in the hematoma (Fig. 1B), left-side dominant areas of hyperintensity were detected along the cerebral cortex on ASL (TR = 4500 ms, TE = 10 ms, and post-labeling delay = 1500 ms) (Fig. 1C). The blood flow in the left cerebral hemisphere was increased (Table 1). Electroencephalography performed 6 h after the seizure showed left-sided slow activity, but no epileptic discharges were apparent. The patient did not experience any recurrence of attacks during hospitalization. On day 19, hyperperfusion in the left hemisphere was diminished on follow-up MRI (Fig. 1D, Table 1). Early seizure due to putaminal hemorrhage (secondary generalization of focal seizure) was diagnosed, and no anticonvulsants were administered. On day 23, she was transferred to a rehabilitation hospital.

2. Discussion

Early seizure is defined as seizure occurring within the first 2 weeks after stroke [3]. The diagnosis of early seizure is not difficult when the typical clinical course characterized by hemi-convulsions is witnessed, as in the present case. However, in some post-stroke patients who develop aphasia or paralysis without a witness of convulsions, diagnosis requires differentiation from recurrent stroke, Todd's palsy, and seizures (including non-convulsive seizures). Although electroencephalography, single photon emission computed tomography, and positron emission tomography are useful for the diagnosis of seizures [4], these devices may not be available at any time in most emergency departments. Perilesional blood flow is depressed during the acute phase after intracerebral hemorrhage [5]. On the other hand, the blood flow around the seizure focus is increased during the peri-ictal period [6]. ASL is a



Fig. 1. Initial plain CT shows acute hemorrhage in the left putamen (A). T2*-weighted imaging shows no interval changes in the hematoma, and arterial spin labeling shows left-side dominant hyperintensity along the cerebral cortex soon after the seizure (B, C). Hyperintensity is diminished 10 days later (D).



Fig. 1 (continued).

Table 1 Cerebral blood flows in cerebral hemisphere measured with arterial spin-labeling.

	Cerebral blood flow (ml/100 g/min)		
	Right	Left	Left/Right
Day 9 Day 19	17.95 17.51	36.47 24.75	2.0 1.4

non-invasive imaging sequence of MRI to evaluate cerebral perfusion without requiring administration of contrast agent [7]. ASL imaging can detect the cortical hyperperfusion that occurs in the peri-ictal phase of the seizure [8–10]. Although ASL has recently been reported as useful in the differentiation of late seizure from recurrent stroke [2], its usefulness in early seizure has not previously been described.

In the present case, ASL imaging revealed hyperperfusion on the affected side of the cerebral cortex in the peri-ictal phase followed by normalization in the inter-ictal state, and these temporary perfusion changes are consistent with the findings observed in epileptic seizure. Non-invasive ASL requires only a few minutes and involves no additional cost if it is incorporated in the protocol as one of the MRI sequences. Through this first report of the detection of early seizure after stroke using ASL, we suggest that active introduction of this MRI sequence may contribute to prompt diagnosis of neurological abnormalities developing early after stroke due to simultaneous evaluation of changes to both cerebral perfusion and the primary stroke lesion.

Conflict of interest

The authors declare that there are no conflicts of interest.

References

- Deibler AR, Pollock JM, Kraft RA, Tan H, Burdette JH, Maldjian JA. Arterial spinlabeling in routine clinical practice, part 2: hypoperfusion patterns. AJNR Am J Neuroradiol 2008;29:1235–41.
- [2] Miyaji Y, Yokoyama M, Kawabata Y, Joki H, Kushi Y, Yokoi Y, et al. Arterial spinlabeling magnetic resonance imaging for diagnosis of late seizure after stroke. J Neurol Sci 2014;339:87–90.
- [3] Louis S, McDowell F. Epileptic seizures in nonembolic cerebral infarction. Arch Neurol 1967;17:414–8.
- [4] Noachtar S, Remi J. The role of EEG in epilepsy: a critical review. Epilepsy Behav 2009;15:22–33.

- [5] Mayer SA, Lignelli A, Fink ME, Kessler DB, Thomas CE, Swarup R, et al. Perilesional blood flow and edema formation in acute intracerebral hemorrhage: a SPECT study. Stroke 1998;29:1791–8.
- [6] Lang W, Podreka I, Suess E, Muller C, Zeitlhofer J, Deecke L. Single photon emission computerized tomography during and between seizures. J Neurol 1988;235:277–84.
- [7] Detre JA, Alsop DC. Perfusion magnetic resonance imaging with continuous arterial spin labeling: methods and clinical applications in the central nervous system. Eur J Radiol 1999;30:115–24.
- [8] Altrichter S, Pendse N, Wissmeyer M, Jagersberg M, Federspiel A, Viallon M, et al. Arterial spin-labeling demonstrates ictal cortical hyperperfusion in epilepsy secondary to hemimegalencephaly. J Neuroradiol 2009;36:303–5.
- [9] Pendse N, Wissmeyer M, Altrichter S, Vargas M, Delavelle J, Viallon M, et al. Interictal arterial spin-labeling MRI perfusion in intractable epilepsy. J Neuroradiol 2010;37: 60–3.
- [10] Wissmeyer M, Altrichter S, Pereira VM, Viallon M, Federspiel A, Seeck M, et al. Arterial spin-labeling MRI perfusion in tuberous sclerosis: correlation with PET. J Neuroradiol 2010;37:127–30.

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