Shimane J. Med. Sci., Vol.28 pp.55-58, 2011

A Case of Acute Basilar Artery Occlusion for Which an Early Diagnosis Was Obtained by Flow-sensitive Alternating Inversion Recovery Magnetic Resonance Imaging

Hidemasa NAGAI, Takeshi MIYAZAKI, Daikei TAKADA, Mituhiro DAISU, Keiji SUGIMOTO and Yasuhiko AKIYAMA

Department of Neurosurgery, Shimane University Faculty of Medicine, Izumo 693-8501, Shimane, Japan

（Received July 29, 2011; Accepted September 1, 2011）

Acute basilar artery occlusion（BAO）has a diagnosis difficulty and a poor prognosis. We report the use of tissue plasminogen activator intravenous therapy for BAO within 30 minutes of the initial symptoms, in a patient who underwent flow-sensitive alternating inversion recovery（FAIR）-MR imaging. The presence of an ischemic penumbra is an important indicator of potentially better clinical outcome and fewer hemorrhagic complications resulting from thrombolysis therapy. This information can be obtained by comparison between the diffusion image and perfusion image of FAIR. An 85-year-old woman with chronic subdural hematoma underwent burr-hole surgery, and postoperatively the residual subdural fluid collection was well controlled. Three weeks later, she suddenly developed basilar artery thromboembolism and received t-PA intravenous therapy. Her modified NIH stroke scale score recovered from 20 to 7 without hemorrhagic complications. We believe that FAIR-MR could become a valuable tool for taking thrombolysis therapy in patients with acute cerebral infarction.

Key words: arterial spin labeling（ASL）, basilar artery occlusion, chronic subdural hematoma, flow-sensitive alternating inversion recovery（FAIR）, penumbra, tissue-type plasminogen activator（tPA）

Correspondence: Hidemasa Nagai, Enya 89-1, Izumo city, Shimane 693-8501, Japan
Tel:+81-853-202245
Fax:+81-853-218954
Email:h-nagai@med.shimane-u.ac.jp

INTRODUCTION

Flow-sensitive alternating inversion recovery（FAIR）imaging is an arterial spin-labeling（ASL）technique that employs short-duration radiofrequency pulses［1］. A discrepancy between a low-perfusion area demonstrated by FAIR and no change of diffusion area demonstrated by diffusion-weighted imaging（DWI）indicates a diffusion-perfusion mismatch, including the presence of an ischemic penumbra. The penumbra is an important feature that can indicate a potentially better clinical outcome of thrombolytic therapy with fewer hemorrhagic complications.

Here we report a patient with basilar artery occlusion（BAO）who underwent magnetic resonance（MR）imaging including FAIR within 30 minutes of symptom onset. This case emphasizes the usefulness of FAIR-MRI for expediting prompt and confident treatment of BAO which diagnosis is more difficult than for acute stroke in the supratentorial region［2］.

PATIENTS CASE

An 85-year-old woman with a history of hypertension and atrial fibrillation, who had been treated with digitalis, angiotension II receptor blocker and aspirin, developed bifrontal chronic subdural hematoma, and underwent left-sided burr-hole surgery. Postoperatively, she remained hospitalized for 3 weeks for rehabilitation. However, she suddenly suffered syncope in the early morning on the day of discharge. Her condition deteriorated, and tetraparesis and consciousness disturbance developed（Glasgow Coma Scale=9）. The CT scan revealed

no evidence of cerebral infarction. We carried out a team discussion of this inpatient case on the basis of the Japanese optimal guidelines for tissue-type plasminogen activator (tPA) intravenous therapy [3], and we studied the findings of emergency 3.0 T-MRI (Signa HDx, GE, Milwaukee, USA). DWI demonstrated no infarcts (Fig 1), but an MR angiogram revealed distal-type BAO (Fig 2A). Finally, FAIR imaging (Tl=1200 ms, using co-research sequence of GEYMS, Imaging Application Tech Center) demonstrated flow asymmetry of the right posterior circulation (that was the meanings of low perfusion), although we were unable to acquire an image of the brainstem (Fig 3). The FAIR image was taken by almost 10 minutes. After obtaining informed consent and approval for IV-tPA therapy from the patient's family, we administered Arteplase ($1400*10^4$ Units) within 1.5 hours after stroke onset. We did not perform the enhanced perfusion MR imaging due to the risk of contrast agent. We

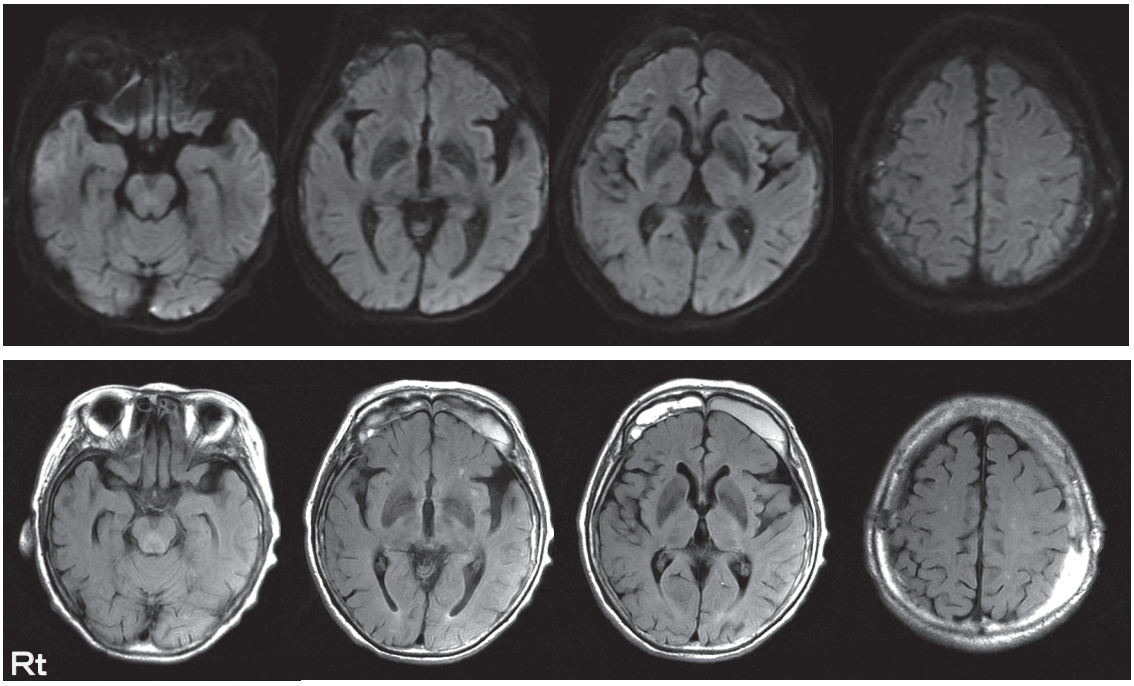

Fig. 1. Diffusion-weighted image (upper) and fluid attenuation inversion recovery (lower) within 30 min of stroke onset reveals no signal intensity change.

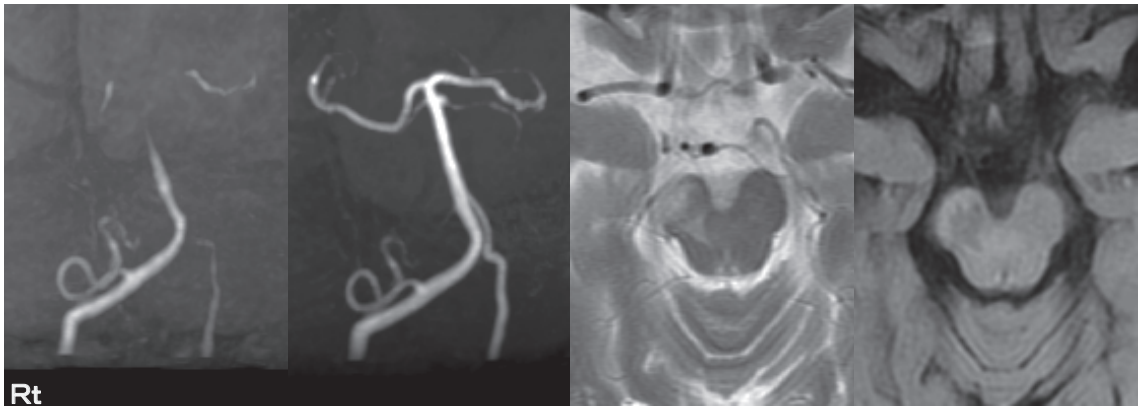

Fig. 2.
A: MR angiogram obtained within 30 min of stroke onset demonstrates distal-type BAO.
B: MR angiogram obtained one month after IV-tPA reveals recanalization of the basilar artery.
C&D: The infarcted area in the right cerebral peduncle of the midbrain is revealed by a T2-FLAIR image one month after IV-tPA.

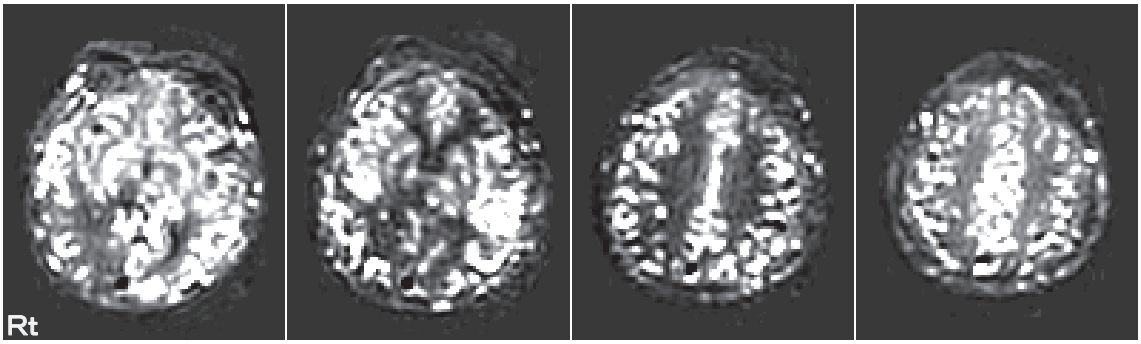

Fig. 3.
Low perfusion is apparent in the right posterior circulation on a flow-sensitive alternating inversion recovery (FAIR) image within 30 min of stroke onset.

did not study single photon emission computed tomography (SPECT) for cerebral blood flow, because of no spare time to do it. Fortunately, the modified National Institutes of Health stroke scale score (NIHSS) recovered from 20 to 7, and there were no hemorrhagic complications including residual subdural fluid collection. MRA demonstrated good recanalization of the distal basilar artery (Fig 2B). T2-FLAIR imaging depicted an infarct in the right cerebral peduncle of the midbrain (Fig 2C, D). The patient was discharged on warfarin 2 mg/day and became able to walk with a cane.

DISCUSSION

This inpatient case of BAO satisfied the criteria for careful administration of IV-tPA, in view of the patient's advanced age, high NIHSS, and the fact she had undergone burr-hole surgery 3 weeks previously. Therefore, the confident information was needed to decide IV-tPA therapy for the patient. Although the worldwide standard guideline for use of IV-tPA is based on CT-proven thrombolysis, MRI-based thrombolysis may be universally applied to acute cerebral ischemic disease. So, we carried out FAIR-MRI to obtain evidence of a penumbra, even though this required extra time in the acute stage. FAIR has a number of merits: (1) It is non-invasive, does not employ exogenous contrast agents, and imposes a lower degree of stress on stroke patients with poor cerebral hemodynamics. (2) It is an easier and less costly method for obtaining perfusion images after routine MRI, including MR angiography and DWI. (3) It enables quicker verification of the vascular territory affected by arterial occlusion [4, 5, 6]. Conversely, the limitations of FAIR are as follows: (1) The total acquisition time is several minutes. (2) The number of sections obtainable is limited. (3) It yields a low signal-to-noise ratio due to artifacts. (4) It may lead to overestimation because of the presence of stronger intravascular signals. (5) Transit time is an issue [4, 5, 6]. The transit delay of FAIR indicates an inversion time (TI) range of about 500 to 1600 ms. Kim et al. reported that FAIR with an intermediate (1200 ms) or short (800 ms) TI underestimates perfusion in an area where transit time is significantly prolonged [6]. However, FAIR is potentially useful in stroke patients because it allows the optimal TI value to be set in each case. A larger randomized cohort trial to assess the value of FAIR-MRI for thrombolytic therapy is eagerly awaited.

In cases of vertebrobasilar arterial occlusion, the information obtained from FAIR images may be of benefit when planning thrombolysis.

ACKNOWLEDGMENTS

We thank Shinji Hara, Department of Radiology, Shimane University Hospital for his technical support.

REFERENCES

1) Kim SG (1995) Quantification of relative cerebral blood flow change by flow-sensitive alternating inversion recovery (FAIR) technique: ap-

plication to functional mapping. *Magn Reson Med* 34: 293-301.

2）Ferbert A, Brückmann H and Drummen R（1990）Clinical features of proven basilar artery occlusion. *Stroke* 21: 1135-1142.

3）Yamaguchi T, Mori E, Minematsu K, Nakagawara J, Hashi K, Saito I and Shinohara Y（2006）Alteplase at 0.6 mg/kg for acute ischemic stroke within 3 hours of onset: Japan Alteplase Clinical Trial（J-ACT）. *Stroke* 37: 1810-1815.

4）Boss A, Martirosian P, Klose U, Nägele T, Claussen CD and Schick F（2007）FAIR-True-FISP imaging of cerebral perfusion in areas of high magnetic susceptibility differences at 1.5 and 3 Tesla. *J Magn Reson Imaging* 25: 924-931.

5）van Gelderen P, de Zwart JA and Duyn JH（2008）Pittfalls of MRI measurement of white matter perfusion based on arterial spin labeling. *Magn Reson Med* 59: 788-795.

6）Kim HS, Kim SY and Kim JM（2007）Underestimation of cerebral perfusion on flow-sensitive alternating inversion recovery image: semiquantitative evaluation with time-to-peak values. *AJNR* 28: 2008-2013.