

: 1996 8 1999 6 35
 41 (: =28:13, 57 , 27 - 75)
 24
 29 , 8 , 4
 (<1 cm,
 1 - 3 cm, >3 cm) 가
 : 41 24 (58.5%)
 15 (36.6%) . 2 (4.9%)
 15
 7 (7/15) 1 cm
 가 3 , 1 - 3 cm 4 . 6 (6/15) 3 1
 cm , 2 1 - 3 cm , 3 cm 1 가 . 1 1 cm
 2 , 1 3 cm .
 : 36.6%
 (15/41) .

(transient ischemic attack, TIA) (diffusion - weighted image, DWI)

24
 (1, 2). TIA 가 , (10, 11).
 TIA DWI

(magnetic resonance image, MRI) 가

TIA

(3, 4),

(5 - 9).

가

1996 8 1999 6
DWI MRI

499

TIA

1
 2
 2000 1 6 2000 6 19 . 75) 41 (28 , 13 , 57 , 27 - MRI

가 29, 4, 8, 가 13 (1996 8 - 1997 9), 28, (1997 10 - 1999 6) b factor 333, 666, 1000, T2, FLAIR, MRI, T1 (TR 500 ms, TE 15 ms, 5 mm, 2 mm), T1, T2 (FSE, TR 4000 ms, TE 98 ms, 5 mm, 2 mm), FLAIR (TR 10002 ms, TE 123 ms, TI 2200 ms, 7 mm, 3 mm), (epi gradient echo, TR 5000 ms, TE 100 ms, 7 mm, 3 mm) b factor 1000

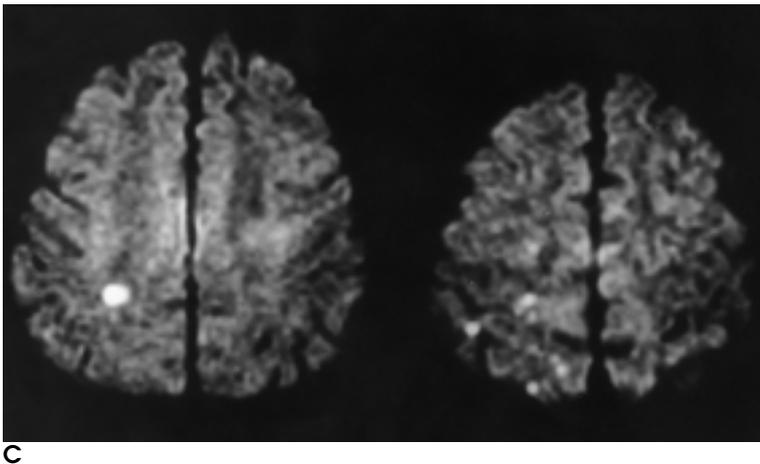
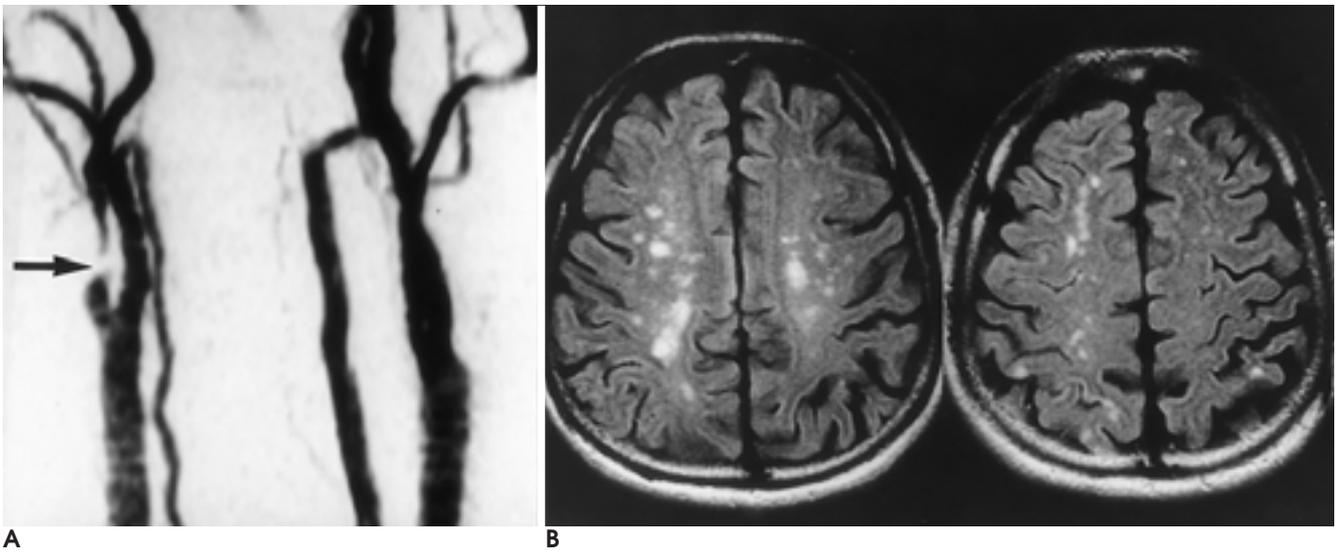


Fig. 1. A 71 year-old male patient was complained of abrupt motor weakness of extremities, lasting about 3-4 hours. He was diagnosed as TIA (transient ischemic attack) with full recovery of neurologic symptoms within initial 24 hours. The time interval between the onset of focal neurologic symptoms and MR exam was 6 days. He had no risk factors of cerebrovascular disease and no evidence of cardioembolic source. This patient showed acute multiple, small infarcts possibly caused by large vessel atherothrombotic disease (LVA).
A. Reversed MIP (maximal intensity projection) image of neck vessel TOF (time of flight) MR angiography shows tight and severe stenosis of right proximal internal carotid artery (black arrow) at the carotid bifurcation.

B. Axial FLAIR (fluid attenuated inversion recovery) images show multiple small or confluent high signal foci in both deep white matters. It is difficult to differentiate acute infarct lesions from small vessel ischemic changes or white matter leukoaraiosis.
C. DWI (diffusion weighted images) definitely delineates multiple small size acute infarctions, scattered in right middle cerebral artery territory, superficial cortical location.

TIA DWI MRI
 41 24 (58.5%)
 17
 (4.9%) 15 (36.6%) 2
 (Table 1).
 15 9
 (Fig. 1).
 (anterior circulation artery) 12
 (posterior circulation artery) 2
 15 5 (33.3%)
 1.5 cm

Table 1. MRI and DWI Findings of TIA (transient ischemic attack)

	Normal	Acute Stroke	Old Stroke
DWI	24 (58.5%)	15 (36.6%)	2 (4.9%)
	Single	9	1
	Multiple	6	1
	Ant. Circulation	13	1
	Post. Circulation	3	1
MRI	3*	2* 5 [†]	1*

* : white matter leukoaraiosis
 † : old lacunar infarction

15 6
 , 7 , 2
 (Table 2).
 6
 가 1 cm 3 가 , 1-3 cm가 2 ,
 3 cm 1 가 .
 (superficial location)가 3 ,
 가 1 , 가 1
 7
 1 cm 가 3 , 1-3 cm가 4 (Fig. 2).
 (lenticulostriate artery) , 1
 , 1 (thalamoperforator)
 2

Table 2. Causes and Vascular Territory of Acute Stroke & Size of the Acute Stroke (n = 15)

	LVA* (n=6)	SVL [†] (n=7)	Cardioembolic (n=2)
Infarct Size			
< 1 cm	3	3	1
1 cm - 3 cm	2	4	
> 3 cm	1		1
Vascular Territory	3 MCA, superficial 1 MCA, deep 1 PCA, deep 1 PICA	6 lenticulostriate A. 1 stem perforator 1 thalamoperforator	1 MCA 1 AICA

* : large vessel atherothrombotic disease
 † : small vessel lacunar disease
 MCA: middle cerebral artery
 PCA: posterior cerebral artery
 PICA: posterior inferior cerebellar artery
 AICA: anterior inferior cerebellar artery

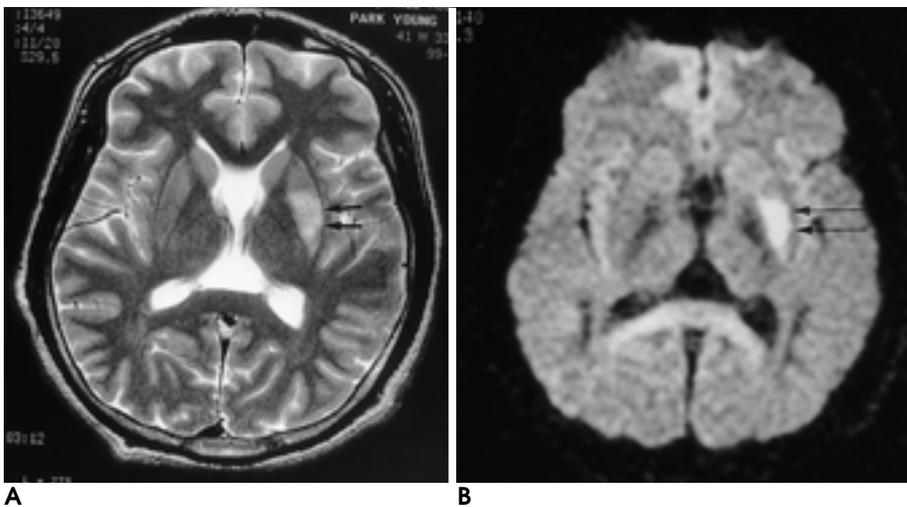


Fig. 2. A 41 year-old male patient with right side weakness was completely recovered within 2 - 3 hours from initial neurologic deficit. The time interval between neurologic symptoms and MR study was 2 days. She was clinically judged by small vessel lacunar disease (SVL) having a small (less than 2 cm) size acute infarction.

A. Axial T2-weighted image shows ovoid high signal intensity lesion (short black arrows) in left basal ganglia, putamen measuring less than 2 cm in diameter.

B. Corresponding axial DWI shows bright signal intensity lesion (long black arrows) in the same area representing acute infarction at the vascular territory of lenticulostriate artery.

1 1 cm , 1 3 cm (Fig. 3).

TIA DWI TIA 24 TIA가 Na⁺ - K⁺ ATPase (sodium - potassium adenosine triphosphate) (13). 가 (ADC, apparent diffusion coefficient) (14, 15). 가 가 Waxman TIA Hasegawa 가 (threshold)가 (16). 가 DWI 가 가 (13, 17), TIA

(8).

(5 - 9). 가

(12). TIA

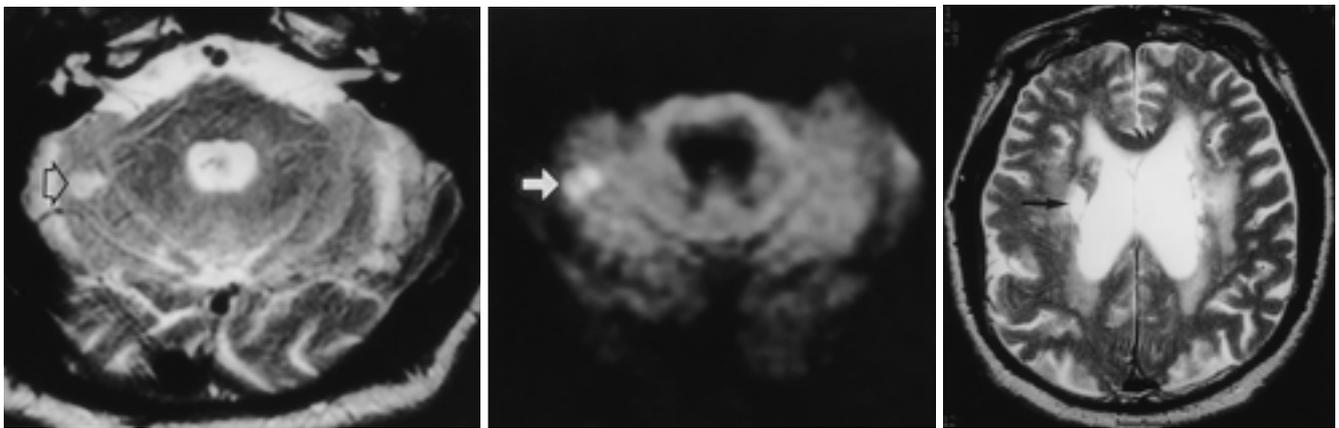


Fig. 3. A 75 year-old male patient was admitted due to right side motor weakness and global aphasia. The initial neurologic deficits were fully recovered after 1 hour. The time interval between the onset of neurological symptoms and MR examination was 2 days. He was found to have an atrial fibrillation on electrocardiography examination however no other risk factors were detected. MR angiography and conventional angiography revealed no evidence of atherosclerotic abnormalities. The possible cause of infarction was made as cardioembolic source.

A. Axial T2-weighted image shows a small, high signal lesion in right cerebellar hemisphere (open black arrow) adjacent to cerebellar peduncle.

B. Axial DWI depicts high signal lesion (short white arrow), acute infarction at the possible vascular territory of AICA (anterior inferior cerebellar artery).

C. Another axial T2-weighted image shows small size, round high signal area (black arrow) locating periventricular deep white matter. It was verified as an old infarction in diffusion weighted MR imaging representing dark signal lesion (not shown). Bilateral confluent high signal lesions are also seen in both periventricular white matters, suggestive of leukoaraiosis.

DWI 가 (18, 19). Kidwell CS TIA , 48% (20/42) (19). TIA 23 가 3 cm 6 DWI TIA (7). TIA 가 7.3 3.2 TIA 가 2 . 21.4% (9/42) DWI 4 DWI 가 (stroke) TIA 가 TIA 가 CT, MR (T2 , FLAIR) 가 , (Fig. 1B) TIA CT MR , T2 , 2-48% (5-9). MR 가 가 T2 (Fig. 3C). (7 mm , 3 mm) DWI 14 TIA (19) 가 TIA TIA TIA 가 TIA SPECT xenon CT (20) (21) 가 TIA DWI 가 MR TIA 가 MTT (mean transit time) 가 rCBF (relative cerebral blood flow) rCBV (relative cerebral blood volume) (22). rCBF가 가 rCBV TIA 가 rCBV

가
TIA
MR
(15/41)
가
TIA
가
TIA
DWI
MR
TIA

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Diffusion Weighted MR Imaging of Transient Ischemic Attacks¹

Jin-Il Chung, M.D., Dong Ik Kim, M.D., Ji Hoe Heo, M.D.², Byung In Lee, M.D.²,
Seung Ik Lee, M.D., Pyeong Ho Yoon, M.D.

¹Department of Diagnostic Radiology, Research Institute of Radiological Science, Yonsei University Medical College

²Department of Neurology, Yonsei University Medical College

Purpose: To investigate the findings of diffusion-weighted MR imaging in patients with transient ischemic attacks (TIA).

Materials and Methods: Between August 1996 and June 1999, 41 TIA patients [M:F = 28:13, mean age 57 (range, 27 - 75) years] with neurologic symptoms lasting less than 24 hours underwent diffusion-weighted MR imaging. The time interval between the onset of symptoms and MR examination was less than one week in 29 patients, from one week to one month in eight, and undetermined in four. Conventional MR and DWI were compared in terms of location of infarction and lesion size (< 1 cm, 1 - 3 cm, > 3 cm), and we also determined the anatomical vascular territory of acute stroke lesions and possible etiologic mechanisms.

Results: The findings of DWI were normal in 24/41 patients (58.5%), while 15 (36.6%) showed acute ischemic lesions. The other two showed old lacunar infarcts. All acute and old DWI lesions were revealed by conventional MR imaging. Among the 15 acute stroke patients, seven had small vessel lacunar disease. In three patients, the infarction was less than 1 cm in size. Six patients showed large vessel infarction in the territory of the MCA, PCA, and PICA; the size of this was less than 1 cm in three patients, 1 - 3 cm in two, and more than 3 cm in one. In two patients, embolic infarction of cardiac origin in the territory of the MCA and AICA was diagnosed.

Conclusion: The possible mechanism of TIA is still undetermined, but acute lesions revealed by DWI in TIA patients tend, in any case, to be small and multiple.

Index words : Magnetic resonance (MR), diffusion study
Transient ischemic attack (TIA)
Brain, ischemia

Address reprint requests to : Jin-Il Chung, M.D., Department of Diagnostic Radiology, Pundang Jesaeng General Hospital, Daejin Medical Center.
255-2, Seohyun-dong, Pundang-gu, Sungnam-si, Kyungki-do 463-050, Korea.
Tel. 82-31-779-0098 Fax. 82-31-779-0062 E-mail: cji@dmc.or.kr

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