

: T2 (T2 Fast Field Echo), FLAIR(Fluid Attenuated Inversion Recovery) , (lesion detection) (lesion conspicuity)

MRI : 7 58 . T2 FFE , FLAIR 33
3가

: 33 108 (86 , 22) T2 FFE
88 (81%), FLAIR 91 (84%), 57 (52%)
16 T2 FFE FLAIR ,
1 T2 FFE
16 (72%), FLAIR 21 (95%), 11 (50%)
가 42 (75%) FLAIR T2 FFE ,
11 (91%)

: FLAIR / T2 FFE
T2 FFE , FLAIR

(CT) MR imaging technique)

가

가

(MRI)

(1-4).

가

T2 (T2 FFE, fast field echo), FLAIR(fluid attenuated inversion recovery) (diffusion weighted MR image) (lesion detection) (lesion conspicuity) (fast

1
2

T2 (T2 FFE), FLAIR , 가

1999 7 1999 12

33 , 33 108

(small vessel disease, encephalomalacia) (,) 86 , (,) 22

T2 FFE 88

(81%), FLAIR 91 (84%)

57 (52%) T2 FFE

72 (84%), FLAIR 70 (81%),

46 (53%)

FLAIR 21 (95%), T2 FFE 16 (73%)

FLAIR (Table 1, Fig. 1).

16 T2 FFE

FLAIR , 1 가

(Fig. 2).

FLAIR T2 FFE , 가 37(66%) , FLAIR

1.5T MR (Philips Gyroscan ACS - NT, Netherlands) T2 FFE (TR/TE 676/23 msec, flip angle 15 °; thickness 5 mm), FLAIR (TR/TE 6000/1000, TI 2000 msec, thickness 5 mm) (echo planar image T2 , b value 1000 sec/mm²)

가

가 28 , 가 5

14 79 (40)

7 58 (18.9)

7 가 1 , 8 30 가 27 , 31 5

27 , 4 , 2 ,

가 1

2

T2 FFE , FLAIR , (intraaxial), (extraaxial)

T2 FFE , FLAIR , 37가

Table 1. Comparison of Sensitivity to Lesion Detection

Sequences	Intraaxial	Extraaxial	Total No.(%)
T2 FFE	72 (84)	16 (73)	88 (81)
FLAIR	70 (81)	21 (95)	91 (84)
DWI	46 (53)	11 (50)	57 (52)
Total No.	86	22	108

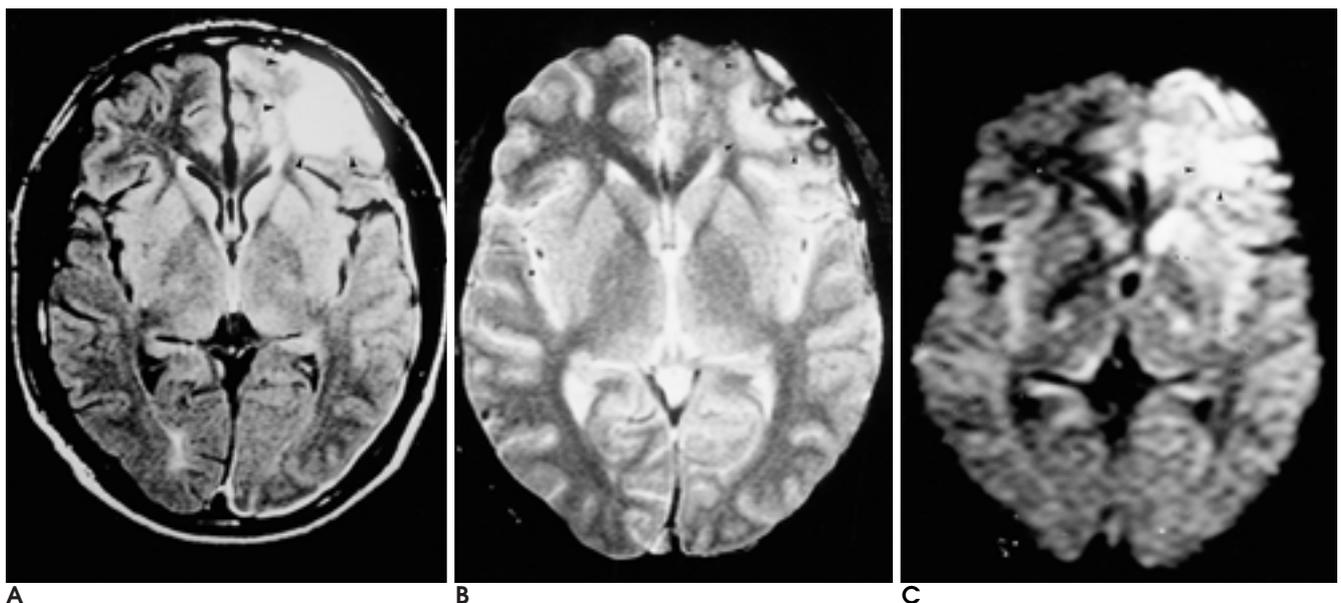


Fig. 1. Brain cortical contusion and subdural hemorrhage in 40-year-old man. FLAIR(A), T2 FFE(B) and diffusion weighted(C) images show left frontal high signal intensity due to brain contusion. FLAIR images shows the left frontal lesion more conspicuously than other pulse sequence images. Lt. subdural hematoma only detected on FLAIR images

Table 2. Comparison of Lesion Conspicuity

Sequences	Intraaxial	Extraaxial	Total No (%)
FALIR > T2 FFE > DWI	27(66)	10(83)	37(66)
FLAIR > DWI > T2 FFE	4(9)	1(8)	5(9)
T2 FFE > FLAIR > DWI	5(11)	0	5(9)
T2 FFE > DWI > FLAIR	0	0	0
DWI > FLAIR > T2FFE	8(18)	1(8)	9(16)
DWI > T2FFE > FLAIR	0	0	0
	44	12	56

56 , T2 FFE (75%) FLAIR 가 5(9%)
 42 FLAIR 12
 11 (91%) FLAIR 9 (16%)
 (Table 2, Fig. 1). 가 7 ,
 가 1 , 가 1 (Fig. 3).

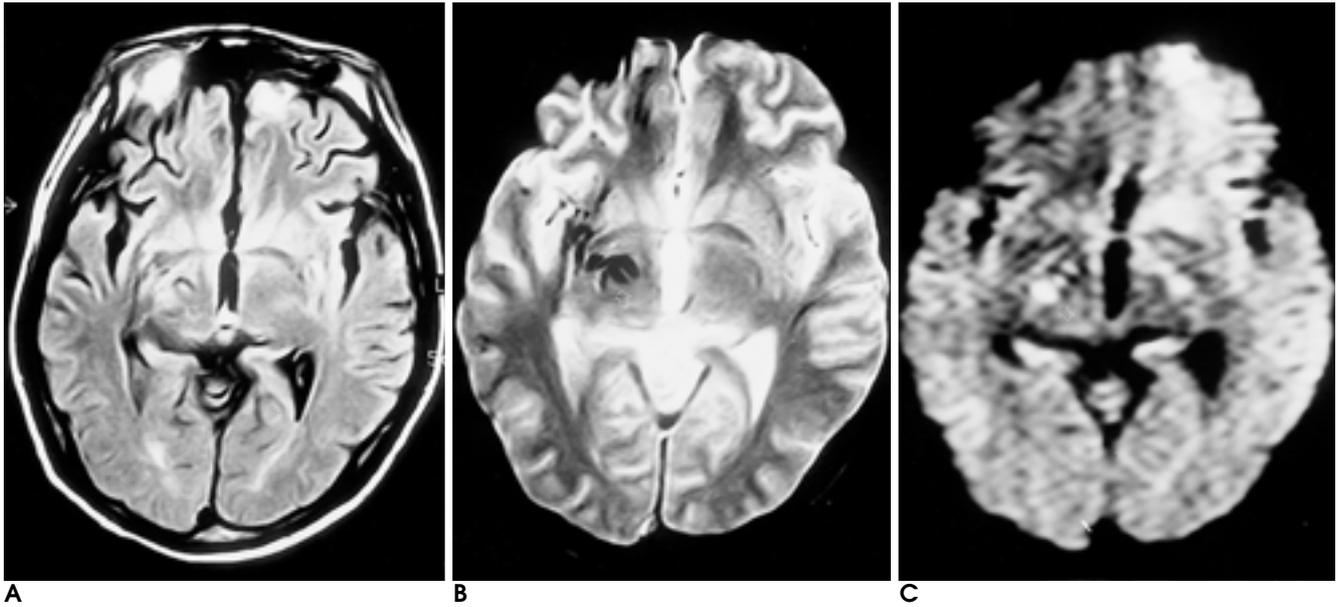


Fig. 2. Small petechial hemorrhage in 16-year-old man. FLAIR(A), T2 FFE(B) and diffusion weighted(C) images show right thalamic hemorrhage. But Right. basal ganglia low signal intensities due to hemorrhage only detected on T2 FFE images.

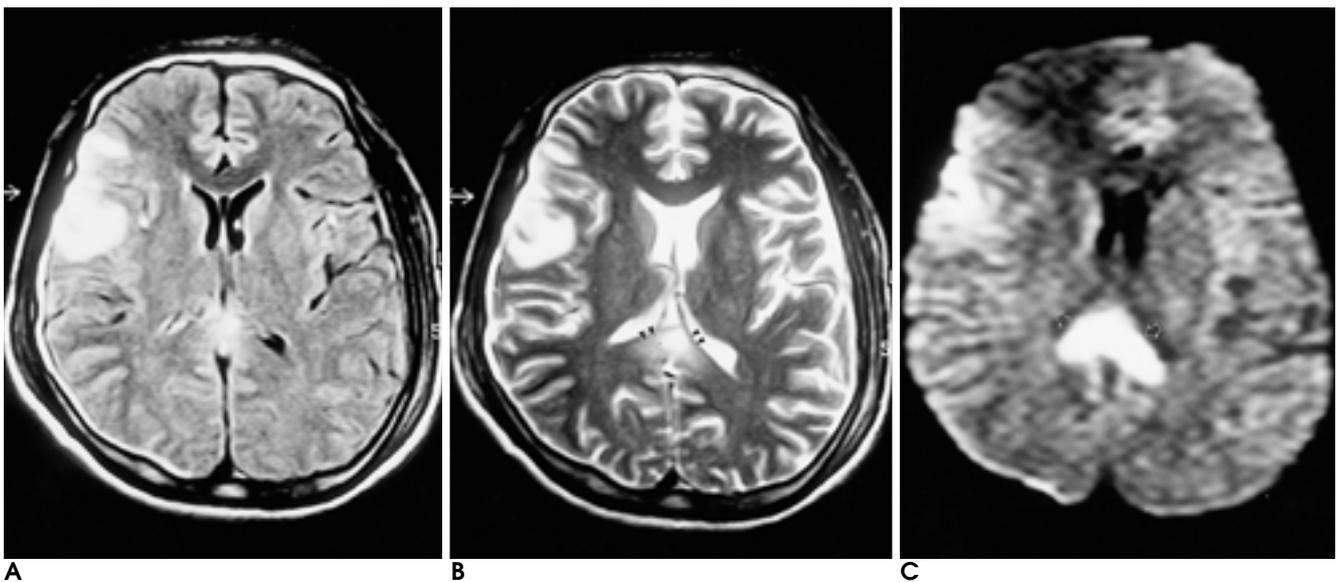


Fig. 3. Diffuse axonal injury in 34-year-old man. FLAIR(A), T2 FFE(B) and diffusion weighted(C) images show the corpus callosum splenial high signal intensity due to diffuse axonal injury. Diffusion weighted images shows the corpus callosum high signal intensity more conspicuously than other pulse sequence images Right. temporal lesion detected more conspicuously on FLAIR (A) than other pulse sequence images.

: T2 (T2 FFE), FLAIR ,
 90 °- 180 ° 180 °
 T2
 fluid attenuated inversion
 recovery (FLAIR) sequence가
 , (basal
 cistern) , (brain stem), (periventricular)
 (12 - 14).
 FLAIR
 GCS (Glasgow Coma Scale), Glasgow outcome
 scale score (13, 15).
 (1 - 5). FLAIR
 10
 T1
 T2
 FLAIR
 (2 - 6) (final outcome) (16 - 18)
 (7 - 10). Liu (19)
 가
 가
 (monitoring) ,
 가 7
 10 (1).
 (magnetic susceptibility)
 (paramagnetic blood)
 breakdown product) FLAIR
 (static field inhomogeneity)
 T2
 T2 FFE . FLAIR
 T2 FFE
 (1). FLAIR
 가 T2 FFE
 (11). MR
 T2 FFE (Fast field Echo)
 T2 FFE

T2

가

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A Comparison of Lesion Detection and Conspicuity on T2-weighted Images (T2 FFE), FLAIR and Diffusion-weighted Images in Patients with Traumatic Brain Injury¹

Eun Yong Kwon, M.D., Myeong Sub Lee, M.D., Myung Soon Kim, M.D.,
In Soo Hong, M.D., Young Ju Kim, M.D., Gum Whang, M.D.²

¹Department of Radiology, Yonsei University, Wonju College of Medicine

²Department of Neurosurgery, Yonsei University, Wonju College of Medicine

Purpose: To compare the lesion detectability and conspicuity in traumatic brain injury on T-2 FFE, FLAIR and diffusion weighted imaging (DWI) sequences.

Materials and Methods: Thirty-three patients who underwent MR brain imaging after traumatic brain injury were reviewed. T-2 FFE, FLAIR and diffusion-weighted MR sequences were obtained and were compared in terms of the detectability and conspicuity of intra- and extra- axial lesions which showed abnormal signal intensities.

Results: Among 33 patients, a total of 108 lesions were found. T-2 FFE sequences detected 88(81%) of these, FLAIR sequences 91(84%), and diffusion-weighted sequences 57(52%). In the case of petechial hemorrhagic lesions, 16 were detected by T-2 FFE imaging but only one by FLAIR and one by DWI. Sixteen extra-axial lesions (73%) were detected by T-2 FFE, 21 (95%) by FLAIR, and 11(50%) by DWI. Lesion conspicuity on FLAIR images was judged superior to that on T-2 FFE and diffusion-weighted images in 42 lesions (75%). Eleven extra-axial Lesions (92%) were more conspicuous on FLAIR than on T-2 FFE and DWI.

Conclusion: For detecting traumatic brain lesions and determining their conspicuity, FLAIR imaging was more useful than T-2 FFE and diffusion weighting, while T-2 FFE imaging was more sensitive for the detection of petechial hemorrhage. Although diffusion-weighted imaging was generally inferior to both FLAIR and T-2 FFE in terms of lesion detection and conspicuity, for some lesions it was superior. The results suggest that images obtained at each pulse sequence can be used as complementary imaging sequences, and that in traumatic brain injury, the acquisition of FLAIR, T-2 FFE and diffusion-weighted images is useful.

Index words : Brain, MR
Brain, injuries
Magnetic resonance (MR)

Address reprint requests to : Myeong Sub Lee, M.D., Department of Radiology, Wonju Christian Hospital, Yonsei University, Wonju college of Medicine, 162, Ilisan - Dong, Wonju, Kangwon-Do, 220-701, Korea.
Tel. 82-33-741-1467 E-mail: cursor2@wonju.yonsei.ac.kr

