

1

2

:
: 2004 2 2007 2
9
, single shot spin echo EPI
가
FLAIR T1
가 T1 T2
가
FLAIR, T2
가
, 8 (89%)
, 6 (67%)
 $\pm 0.117 (10^{-3} \text{ mm}^2/\text{sec})$
1.052 \pm 0.149 ($10^{-3} \text{ mm}^2/\text{sec}$)
0.735

(ependymitis), (ventricular empyema),
(pyocephalus)
(6-8).
가 가
(1).

(fluid attenuated inversion recovery: FLAIR)
(2-5).
2004 2 2007 2
9

가 5 , 4
52.8 (34-70)

1가
2

2007 3 23

2007 7 12

2 - 3 mm
3 (Apparent Diffusion Coefficient)

(cortical gray matter) ADC

MR Protocol
1.5 T MR (Signa Excite Twin Speed, GE Medical Systems, Milwaukee, WI, U.S.A.)
Quadrature head coil single-shot spin-echo echo-planar (TR/TE = 4000/110 msec, 128 × 128 matrix, 24 cm field of view, 5 mm thickness, 2 mm interslice gap, NEX = 2)
b value (0, 1000 mm²/sec)
T1 (600 msec/14 msec, repetition time/echo time) fast spin echo T2 (4000/110), FLAIR (8800/190 inversion time 2200)
((gadopentetate dimeglumine)) (Magnevist, Schering, Berlin, Germany) 0.1 mmol/kg

Student t test two-tailed independent p value가 0.05 (two-tailed)

(intra-cranial hemorrhage) 2 (n=3), (n=2)

5 4 가

2 - 10 (> 38 °C), 가 7 가 6 (67%) 3 15 가

(ependymal layer) 가 (staphylococcus aureus) (n=2), (streptococcus species) (n=1), (Escherichia coli) (n=1), (Pseudomonas aeruginosa) (n=1), (Gram-negative bacilli) (n=1)

(internal cerebral vein) (thin) (thick) 8 6 , 3

b value (ADC map)

Table 1. MR Imaging Findings in 9 Patients with Pyogenic Ventriculitis

Patient[No]/ Sex/Age	MR finding of ventricular debris*				Mean ADC (VD) (10 ⁻³ mm ² /sec)	Mean ADC (GM) (10 ⁻³ mm ² /sec)
	T1WI	T2WI	Enhanced [†]	DWI		
1/M/34	Hypo	Mild hyper	Thin, linear	Hyper	0.573	0.786
2/M/40	Hypo	Hyper	Thin, linear	Hyper	0.813	1.052
3/F/63	Mild hypo	Hyper	Thick, linear	Hyper	0.767	1.055
4/F/66	Hypo	Hyper	Thin, linear	Hyper	0.719	1.192
5/F/55	Hypo	Hyper	Thick, linear	Hyper	0.543	1.21
6/M/70	Mild hypo	Hyper	Thick, linear	Hyper	0.865	1.16
7/M/35	Hypo	Hyper	Thin, linear	Hyper	0.825	0.843
8/M/59	Hypo	Hyper	Thin, linear	Hyper	0.67	1.025
9/F/65	Hypo	Hyper	None	Hyper	0.84	1.13

Note. - VD, ventricular debris; GM, gray matter; T1WI, T1-weighted image; T2WI, T2-weighted image; DWI, diffusion-weighted image

* Signal intensity relative to that of gray matter

[†] Morphology of the enhancing ependymal layer; Thick, comparable to thickness of internal cerebral vein; Thin, thinner than thickness of internal cerebral vein

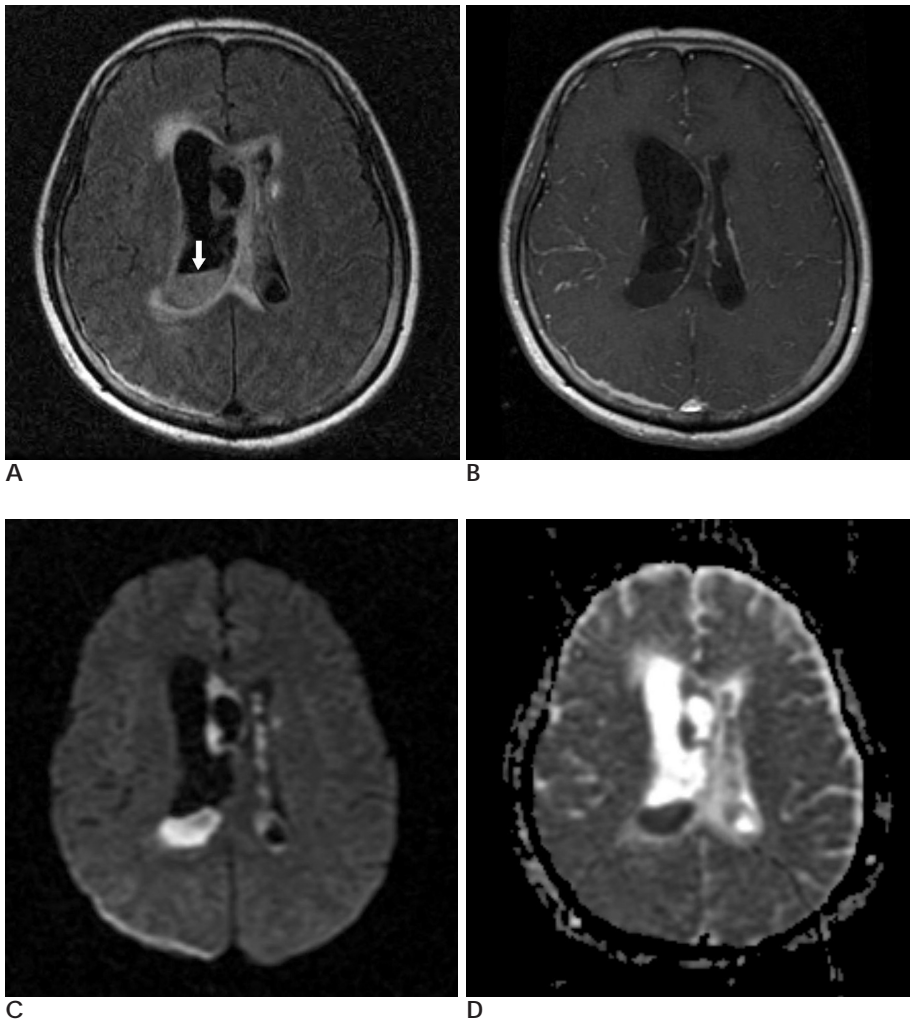


Fig. 1. 66-year-old female with purulent ventriculitis after evacuation of cerebellar hemorrhage and extraventricular drain catheter insertion.

A. FLAIR image (8800/190 inversion time 2200) shows hyperintense debris in both lateral ventricles with oblique layering in right lateral ventricle (arrow).

B. Contrast enhanced axial T1-weighted image (TR/TE, 600/14) shows thin and linear ependymal enhancement.

C. Diffusion-weighted image (4000/110, b value 1000 m^2/sec) obtained at the level of the lateral ventricles reveals strong hyperintensity in the dependent position.

D. At the same level as the image in C, this apparent diffusion coefficient (ADC) map shows hypointensity, consistent with restricted water diffusion.

(Table 1).

FLAIR
(Fig. 1).

T1
가 7, 2

1

가

FLAIR

9 6 (67%)
가 FLAIR

T2

FLAIR

5 T1
3

(Fig. 2). 2

(Fig. 3). 3

(choroids plexitis)

2

T2

$0.735 \pm 0.117 (10^{-3} \text{ mm}^2/\text{sec})$

$1.052 \pm 0.149 (10^{-3} \text{ mm}^2/\text{sec})$

($p < 0.001$).

2

(extraventricular drainage)

2

가 가 가

가

가

(9).

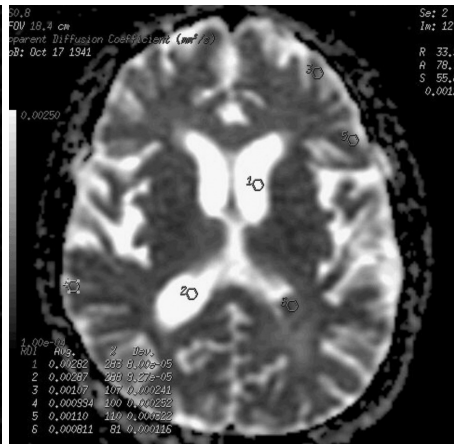
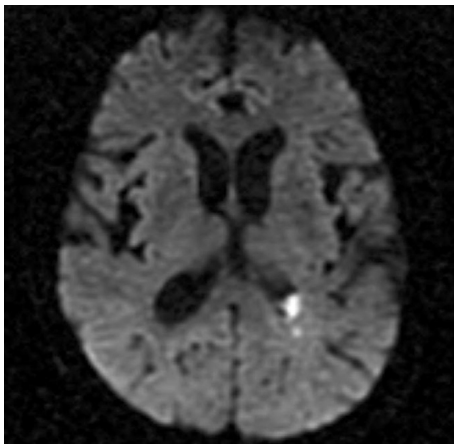
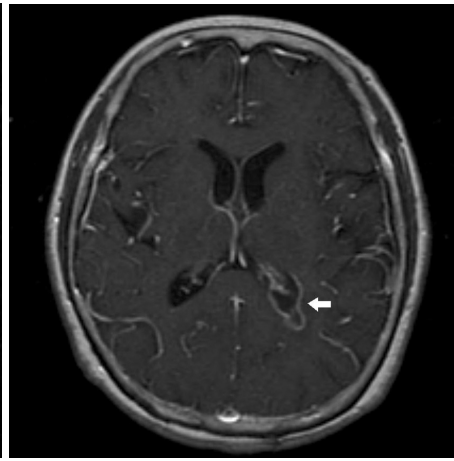
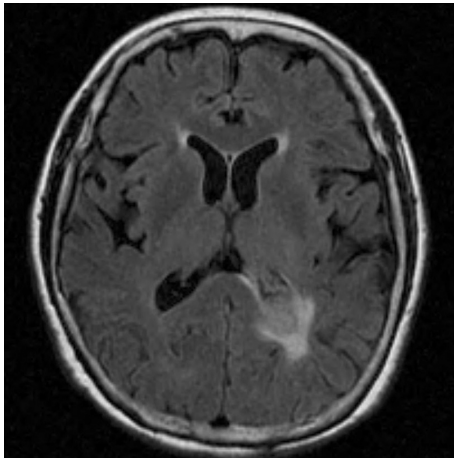


Fig. 2. 63-year-old female with bacterial meningitis.

A. FLAIR image shows ventricular debris in the left atrium. Hyperintense signal around ventricle is consistent with periventricular inflammation.

B. Contrast enhanced axial T1-weighted image shows abnormal thick and linear enhancement along the ventricular wall (arrow).

C. Diffusion-weighted image shows ventricular debris in dependent position of atrium and marked hyperintense signal compared with cerebrospinal fluid and brain.

D. Apparent diffusion coefficient (ADC) map shows that pus in more dependant position has lower apparent diffusion coefficient (0.811×10^{-3} mm²/sec) than gray matter. Circular regions of interest are outlined and numbered.

(fluid fluid level)

Fukui

9 6

3

T1

가 ,
FLAIR

가

가

FLAIR

FLAIR

(5)

T1 T2

가 FLAIR

(5 - 7).

 $(4, 5),$

12).

가 (10 -

132

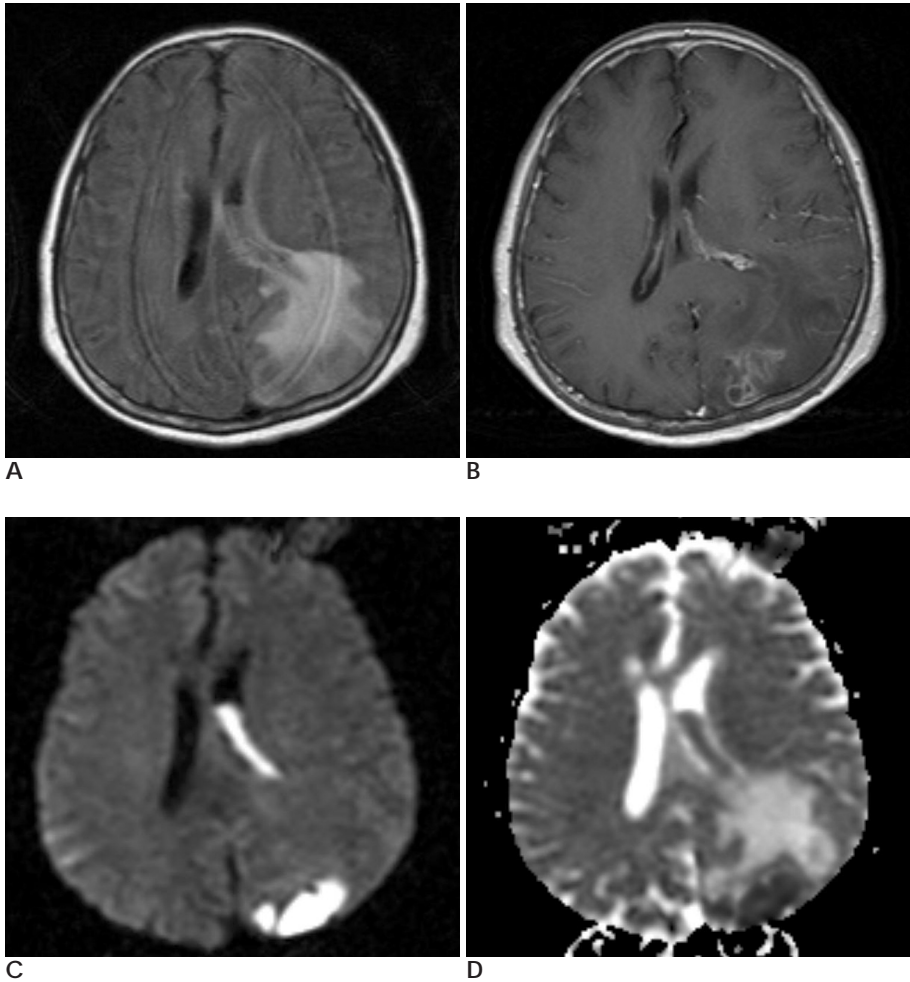


Fig. 3. 65-year-old female with brain abscess and choroid plexitis.

A. FLAIR image shows hyperintense debris in left lateral ventricle with extensive periventricular edema.

B. Contrast enhanced axial T1-weighted image shows enhancement of the enlarged choroid plexus and multiple brain abscesses in the occipital lobe.

C. Diffusion-weighted image shows hyperintense signal in the left ventricular debris and brain abscess in the occipital lobe.

D. Apparent diffusion coefficient maps show restricted diffusion in the left ventricular pus and abscess cavity.

FLAIR

FLAIR Fujikawa (8)

(5) 2 , Fukui

Rana (7) 가

가

Rana

가

(13).

가 (14).

2 가

가

가

가

가

(false negative)

가

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The Significance of Diffusion Weighted Imaging for the Diagnosis of Pyogenic Ventriculitis¹

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Purpose: To evaluate the significance of diffusion weighted imaging (DWI) for the diagnosis of pyogenic ventriculitis.

Materials and Methods: In this retrospective study, 9 patients with pyogenic ventriculitis underwent a set of imaging sequences that included DWI, T1- and T2-weighted imaging, FLAIR and enhanced T1 weighted imaging. DWI consisted of an axial single shot spin echo EPI pulse sequence with b values of 0 and 1000 sec/mm². We evaluated the presence and signal intensity of ventricular debris, hydrocephalus, periventricular signal abnormality, and ependymal enhancement. The apparent diffusion coefficient values of ventricular debris and cortical gray matter were calculated from the ADC map.

Results: In all patients, ventricular debris was hyperintense on the DWIs. A periventricular hyperintense signal was present in all cases on FLAIR and T2WI. Ependymal enhancement was detected in eight (89%) of 9 cases. A hydrocephalus was observed in 6 (67%) of 9 cases. The mean ADC value of ventricular debris was 0.735 ± 0.117 (10^{-3} mm²/sec). These ADC values were significantly lower than those for cortical gray matter (1.052 ± 0.149 (10^{-3} mm²/sec)).

Conclusion: Ventricular debris was most conspicuous finding of ventriculitis on DWI. Areas of intraventricular hyperintensity on DWI corresponded to the decreased ADC values.

Index words : Diffusion magnetic resonance imaging
Cerebral ventricles
Encephalitis

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