

FLAIR

: T2

1

2

2

2

: fluid attenuated inversion recovery (FLAIR) T2
FLAIR 가 ,

10.2) , 1.5T MR FLAIR (TR/TE/TI = 10004/
123/2200) T2 (TR/TE = 4000/104) . FLAIR
(detection), (conspicuity), (extent) 2 가
T2 /
(contrast), / (contrast to noise ratio (CNR)), /
, / FLAIR T2 .
가

: 가 , 6 2 (33%) FLAIR T2
, 4 6
FLAIR T2 가 /
/ CNR FLAIR T2 /
/ CNR T2 . 1 FLAIR
가

4 , 1
2
: FLAIR T2

가 T2 90 °-180 ° RF 180 °
(inversion recovery pulse)
(1-7). heavily T2 fluid
T2 가 attenuated inversion recovery (FLAIR)

(8-9).

(pulse sequence) FLAIR

1998 7 16

1998 11 26

가

가 (8).

FLAIR T2

FLAIR 가 ,

1996 1 1998 6 6 , ,

(very long chain fatty acid)

가 6-17 , .

102 , 6

1.5T MR (Signa Horizon, GE Medical Systems, Milwaukee, USA)

T1

T2

FLAIR T1

TR/TE = 450-500/8-14msec, T2 TR/TE = 4000/ 104msec, FLAIR TR/TE/TI = 10004/123/2200msec

, matrix size 192x256, FOV 22cm

가 FLAIR T2

4 1)

, 2) (equivocal), 3) 가

, 4) 가

(detection),

(extent)

spicuity) 2 가

가 FLAIR T2

0.2-0.8cm² , cursor 2-3 .

: FLAIR

(le-

sion/CSF contrast) = (-)/

, / (le-

sion/CSF contrast to noise ratio(CNR)) = (-

) / , /

(lesion/WM contrast) = (-

) / , / (lesion to

WM CNR) = (-)/

FLAIR T2

가 Exact Wilcoxon test .

가(Table 1) 6 2

(33.3%) , ,

FLAIR T2

(Fig.1), 4 (66.7%)

6 FLAIR

T2

(ambient cistern), (supeior cerebellar cistern),

Table 1. Visual Assessment of Lesion between FLAIR and T2WI

	FLAIR> T2WI	FLAIR= T2WI	FLAIR< T2WI
Detection	2	4	0
Extent	6	0	0
Conspicuity	6	0	0

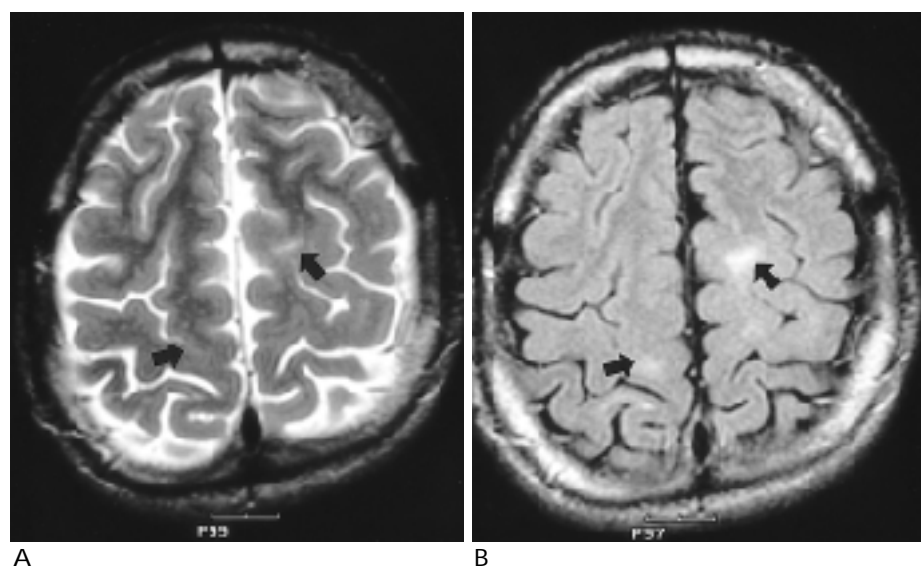


Fig. 1. A 17-year-old boy with visual and motor symptoms.
A) On axial T2-weighted image, the lesions(arrows) are masked by high signal intensity of CSF. B) Axial FLAIR image shows linear high signal lesions(arrows) along superior parietal subcortical white matter.

(basal cistern) , (cerebropon- / / CNR T2
tine angle area) (Fig.2).
가(Table 2) FLAIR / 1 T2
/ CNR T2 가 FLAIR
가

Table 2. Quantitative Assessment of FLAIR and T2WI in the Lesion of Adrenoleukodystrophy(n= 6)

	FLAIR	T2WI	p-value
Lesion/CSF contrast	19.72	0.19	0.016
Lesion/CSF CNR	54.74	22.58	0.03
Lesion/WM contrast	0.99	1.72	0.016
Lesion/WM CNR	27.61	66.66	0.016

Note : CNR= contrast to noise ratio, WM= white matter
CSF= cerebrospinal fluid

(Fig3).

(Table 3),

2

가

1

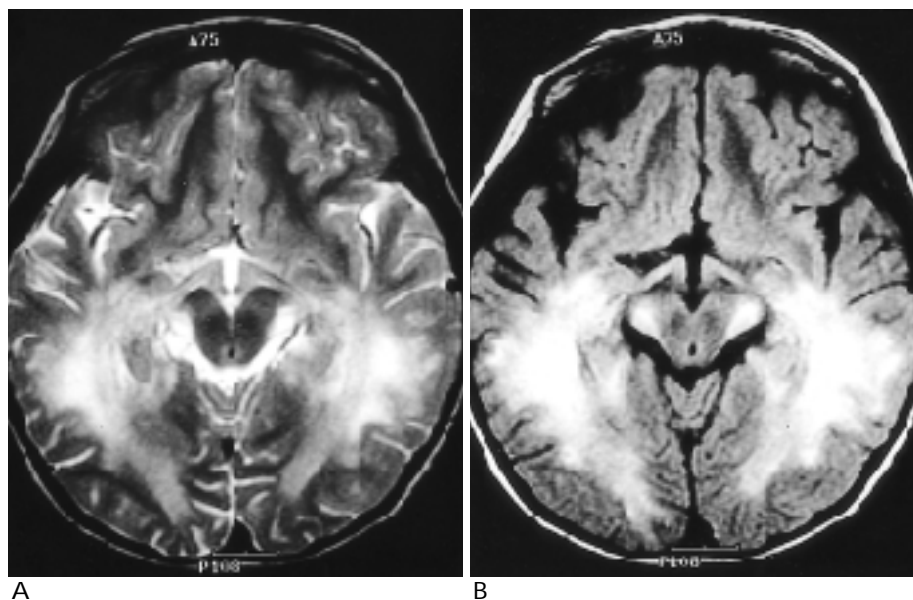


Fig. 2. A 6-year-old boy with visual, auditory, and motor symptoms.
A. Axial T2-weighted image shows high signal intensities in bilateral temporo-occipital white matter and brachium of inferior colliculus.
B. On FLAIR image, the high signal lesions appear to be more discrete, conspicuous, and extensive than those of T2-weighted image.

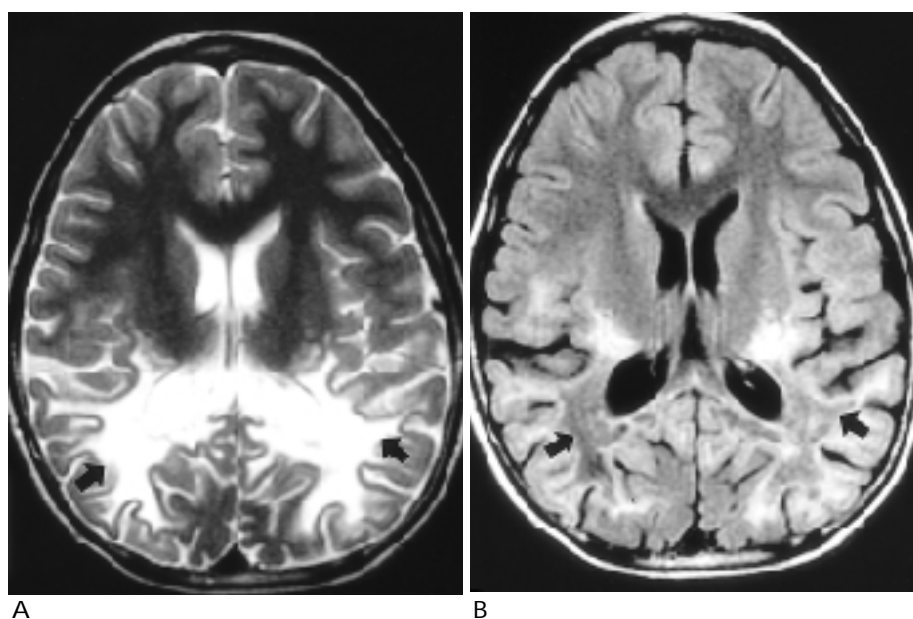


Fig. 3. A 9-year-old boy with visual and auditory symptoms.
A. Axial T2-weighted image shows bilateral confluent high signal intensity areas in temporo-occipital white matter (arrows) and both lateral geniculate bodies.
B. On FLAIR image, bilateral temporo-occipital white matter lesions appear low signal intensity, which indicating encephalomalacic change (arrows).

: FLAIR

some

(Liganoceroyl-coASH ligase)
(very long chain fatty acid)

(1-7).

peroxi-

(centrum semiovale)

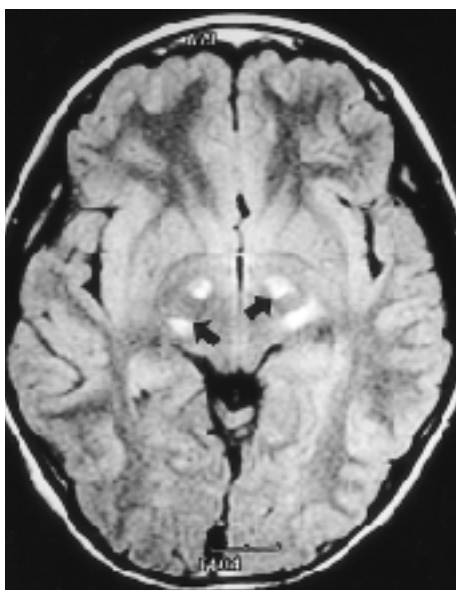
(internal capsule)

Table 3. Correlation of Clinical Symptoms and Lesions on MRI

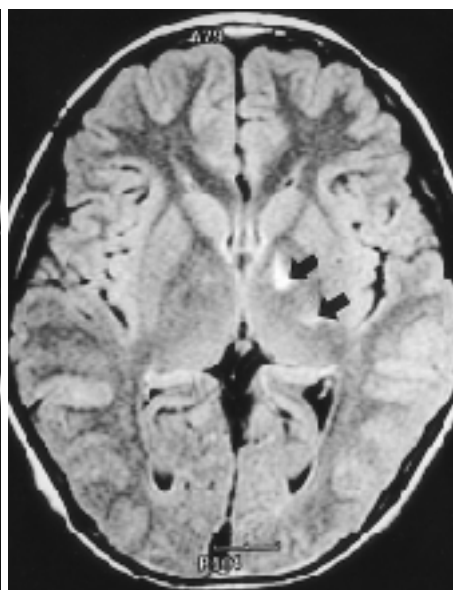
Case No Age/Sex	1* 9/M	2 6/M	3 17/M	4 10/M	5 7/M	6 12/M
Clinical Symptoms	Impaired hearing Impaired vision Exotropia Decreased intelligence	Impaired hearing Impaired vision Gait disturbance Dementia	Impaired vision Progressive gait disturbance Rt.hemiparesis	Impaired hearing Impaired vision Quadriplegia Attention deficit	Asymptomatic	Asymptomatic
Visual Pathway	Optic radiation Lateral geniculate body	Optic radiation Lateral geniculate body	Optic radiation Lateral geniculate body	Optic radiation Lateral geniculate body	Optic radiation Lateral geniculate body	-
Auditory Pathway	Medial geniculate body Auditory radiation	Lateral lemniscus Brachium of inferior colliculus Medial geniculate body Auditory radiation	-	Medial geniculate body Auditory radiation	-	-
Motor Pathway	Internal capsule (Post.limb) Cerebral peduncle Pyramidal tract	Internal capsule (Post.limb) Cerebral peduncle Pyramidal tract	Internal capsule (Post.limb) Cerebral peduncle Pyramidal tract	Internal capsule (Post.limb) Cerebral peduncle Pyramidal tract	Internal capsule (Post.limb)	Internal capsule (Post.limb) Cerebral peduncle Pyramidal tract
White matter in cerebral hemisphere (mainly parieto-occipital area)	+	+	+	+	+	+

Note :+ - High signal intensity in white matter of cerebral hemisphere, mainly parieto-occipital area on T2WI and FLAIR image

*- Patient without motor symptom reveals high signal intensity in motor pathway on MRI



A



B

Fig. 4. A asymptomatic 12-year-old boy with adrenoleukodystrophy.

A,B) Axial FLAIR images demonstrate high signal intensities in both cerebral peduncles (arrows) and in the posterior limb of left internal capsule (arrows).

1 (Fig. 3) T2
가 FLAIR(1-7). 4
2
(centrum semiovale) (internal capsule)

(6)

가

T2

가

T2

1

(2).

T2

가

가

Aubourg (13)

(8-10). FLAIR 1800 (inversion
pulse), (inversion time: TI) (echo time:
TE)
heavily T2

가

가

2

(basal cistern), (brain stem),
(periventricular)

FLAIR

FLAIR

T2

(8-12).

FLAIR

T2

FLAIR

(10-11),

FLAIR

T2

/ CNR

FLAIR

T2

(cerebral peduncle),

(pyramidal tract),

(lateral lemniscus)

가

TE

FLAIR

(tract)가

(parietopontine tract),

(medial lemnisci),

(corticospinal tract),

(middle cerebellar peduncle)

(pons)

(cerebellar peduncle),

(medial longitudinal fas-

ciculi),

(occipitothalamic tract)

(11).

(12)

T2

FLAIR

가

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MR Imaging with Fluid Attenuated Inversion Recovery Sequence of Childhood Adrenoleukodystrophy : Comparison with T2 Weighted Spin Echo Imaging¹

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Purpose : The purpose of this study was to evaluate the usefulness of FLAIR(Fluid Attenuated Inversion Recovery) MR imaging in childhood adrenoleukodystrophy by comparing with those of T2-weighted FSE imaging, and to correlate MRI findings with clinical manifestations.

Materials and Methods : Axial FLAIR images(TR/TE/TI= 10004/123/2200) and T2-weighted FSE images(TR/TE= 4000/104) of brain in six male patients(age range : 6-17 years, mean age : 10.2 years) with biochemically confirmed adrenoleukodystrophy were compared visually by two radiologists for detection, conspicuity, and the extent of lesion. Quantitatively, we compared lesion/CSF contrast, lesion/CSF contrast to noise ratio(CNR), lesion/white matter(WM) contrast, and lesion/WM CNR between FLAIR and T2 weighted image. We correlated MR findings with clinical manifestations of neurologic symptoms and evaluated whether MRI could detect white matter lesions in neurologically asymptomatic patients.

Results : Visual detection of lesions was better with FLAIR images in 2 of the 6 cases and it was equal in the remainders. Visual conspicuity and detection of the extent of lesion were superior on FLAIR images than T2-weighted images in all 6 cases. In the quantitative assessment of lesions, FLAIR was superior to T2-weighted image for lesion/CSF contrast and lesion/CSF CNR, but was inferior to T2 weighted image for lesion/WM contrast and lesion/WM CNR. In one case, FLAIR images distinguished the portion of encephalomalacic change from lesions. MR findings of adrenoleukodystrophy were correlated with clinical manifestations in symptomatic 4 cases, and also detected white matter lesions in asymptomatic 2 cases.

Conclusion : MR imaging with FLAIR sequence provided images that were equal or superior to T2-weighted images in the evaluation of childhood adrenoleukodystrophy. MRI findings were well correlated with clinical manifestations and could detect white matter lesions in neurologically asymptomatic adrenoleukodystrophy patients.

Index words : Brain, MR
Brain, diseases
Brain, white matter

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