



가
 : 10 68 (31 ,
 21 , 4 , 3 , 3) , T2
 T1
 T2
 :
 : T2
 15 (22%) , 9 (60%)
 , 6 (40%) T2
 6 (40%)
 15
 가 (independent sample t - test, $p < .05$).
 :
 ,

(1, 2).

가 (3-5). 1997 6 1999 6 10
 (1-9 , 7) 68
 19
 가 (6-16). 71 (44) 가 31 가 37
 68 31 , 21 , 4 , 3 ,
 3 , 2 , (cranio-
 pharyngioma) 1 , (pineocytoma) 1 ,
 (cavernous angioma) 1 , 1 .
 T2 , T1 57 5

1.5T MR (Signa Horizon Echo - speed,
 GE medical system, Milwaukee, U.S.A.)

T1 (TR/TE=467 msec/9 msec) T2
 (TR/TE=3417 msec/96 msec) , Gd - DTPA
 (Magnevist; Schering, Germany; 0.1 - 0.15 mmol/kg)

T1
T2
TR/TE=6500 msec/96.8 msec, 280×280 mm,
128×128, 5 mm, 2 mm 180

b value 900 1000 sec/mm²
3

MR (Echoplus, GE medical
system, Milwaukee, U.S.A.)

T1, T2

(apparent diffusion coefficient, ADC)

가

(Table 1, Figs. 1, 2). 68

57% (39/68)

93% (63/68)

50% (34/68)

39 79% (31/39)

가 T2

, T1

, 36% (14/39)가 T2 T1

, 가

15% (6/39)

63

78% (49/63)

T2

, T1

, 5% (3/63)가 T2

, 48%

(30/63)

T2

T1

24% (15/63)

T2

, T1

T2

T1

, 3% (2/63)

T2

T1

, 2% (1/63)

3

가

18

T2

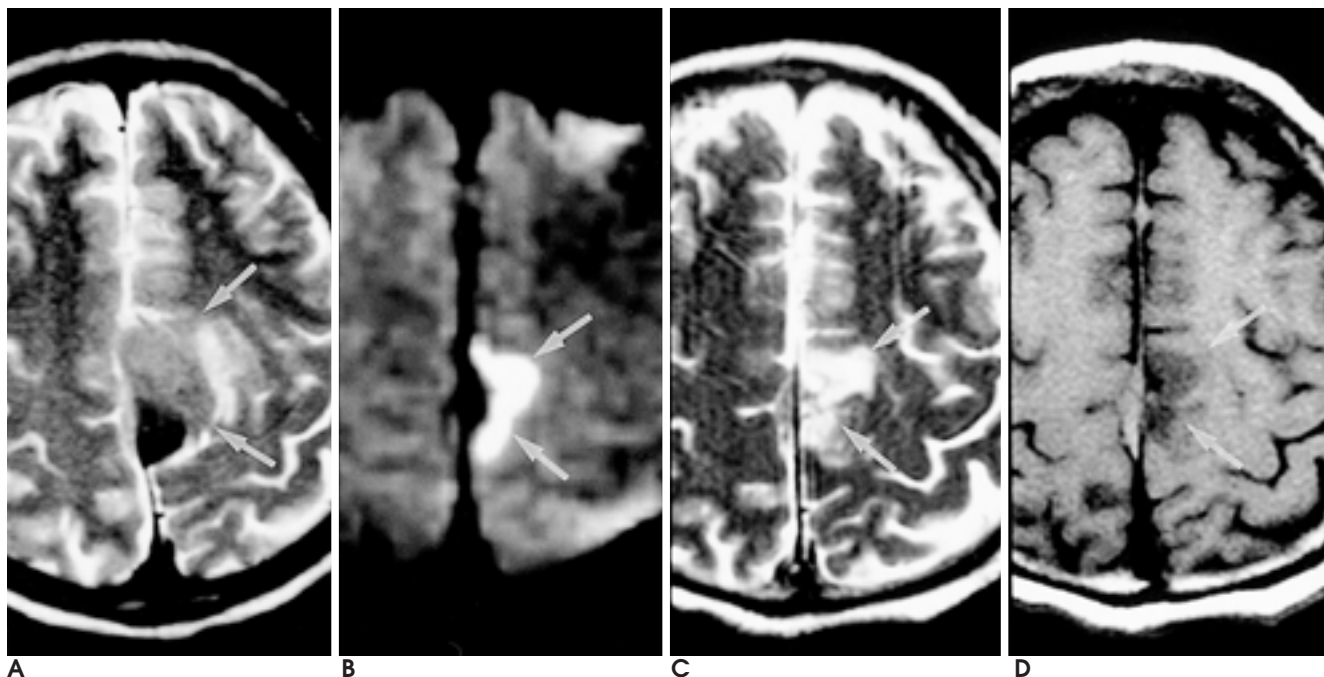


Fig. 1. A 58-year-old male with meningioma.
A. Preoperative T2-weighted image shows a mass in the left parasagittal area (arrows).
B-D. MR images obtained 4 days after tumorectomy. There is high signal intensity along the margin on diffusion-weighted image (B, arrows), and the lesion is hyperintense on T2-weighted image (C, arrows) and hypointense on T1-weighted image (D, arrows).

22% (15/68) , 60% (9/15) T1

, 가 ,

. T1

6

가

(40%)

(17).

(Table 2, Figs. 3, 4).

T2

(18 - 20).

ADC

$0.53 \pm 0.18 \times 10^{-3} \text{ mm}^2/\text{sec}$

T2

$1.55 \pm 0.06 \times 10^{-3} \text{ mm}^2/\text{sec}$

ADC

(inde -

pendent sample t - test, $p < .05$).

가

가

가

Table 1. Signal Intensity of Resection Margin on T2- and Diffusion-weighted MR Imaging in Patients with Brain Tumor after Tumorectomy (n = 68)

Hyperintense on DWI		39*/68 (57%)	Isointense on DWI		63†/68 (93%)
T2WI	T1WI		T2WI	T1WI	
Hyperintense	Hypointense	31/39 (79%)	Hyperintense	Hypointense	49/63 (78%)
Hyperintense	Hyperintense	14/39 (36%)	Hyperintense	Hyperintense	3/63 (5%)
			Isointense	Isointense	30/63 (48%)

* There were six cases that had two pattern of signal intensity.

† There were 17 cases that had two of three patterns of signal intensity and one case that had all of three patterns.

DWI: diffusion-weighted image

T2WI: T2-weighted image

T1WI: T1-weighted image

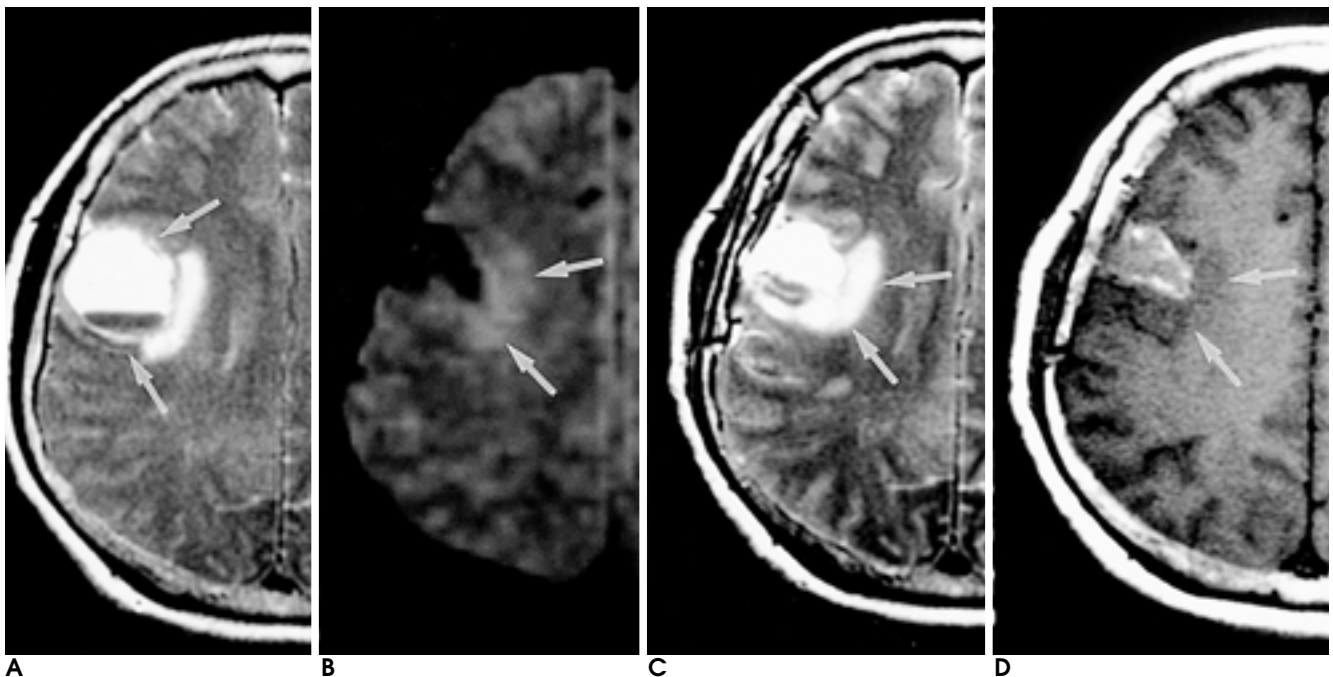


Fig. 2. A 56-year-old female with glioblastoma multiforme.

A. Preoperative T2-weighted image shows a mass with hemorrhage in the right frontal lobe (arrows).

B-D. MR images obtained 8 days after tumorectomy. There is isointensity along the margin on diffusion-weighted image (**B**, arrows), and this area is hyperintense on T2-weighted image (**C**, arrows) and hypointense on T1-weighted image (**D**, arrows).

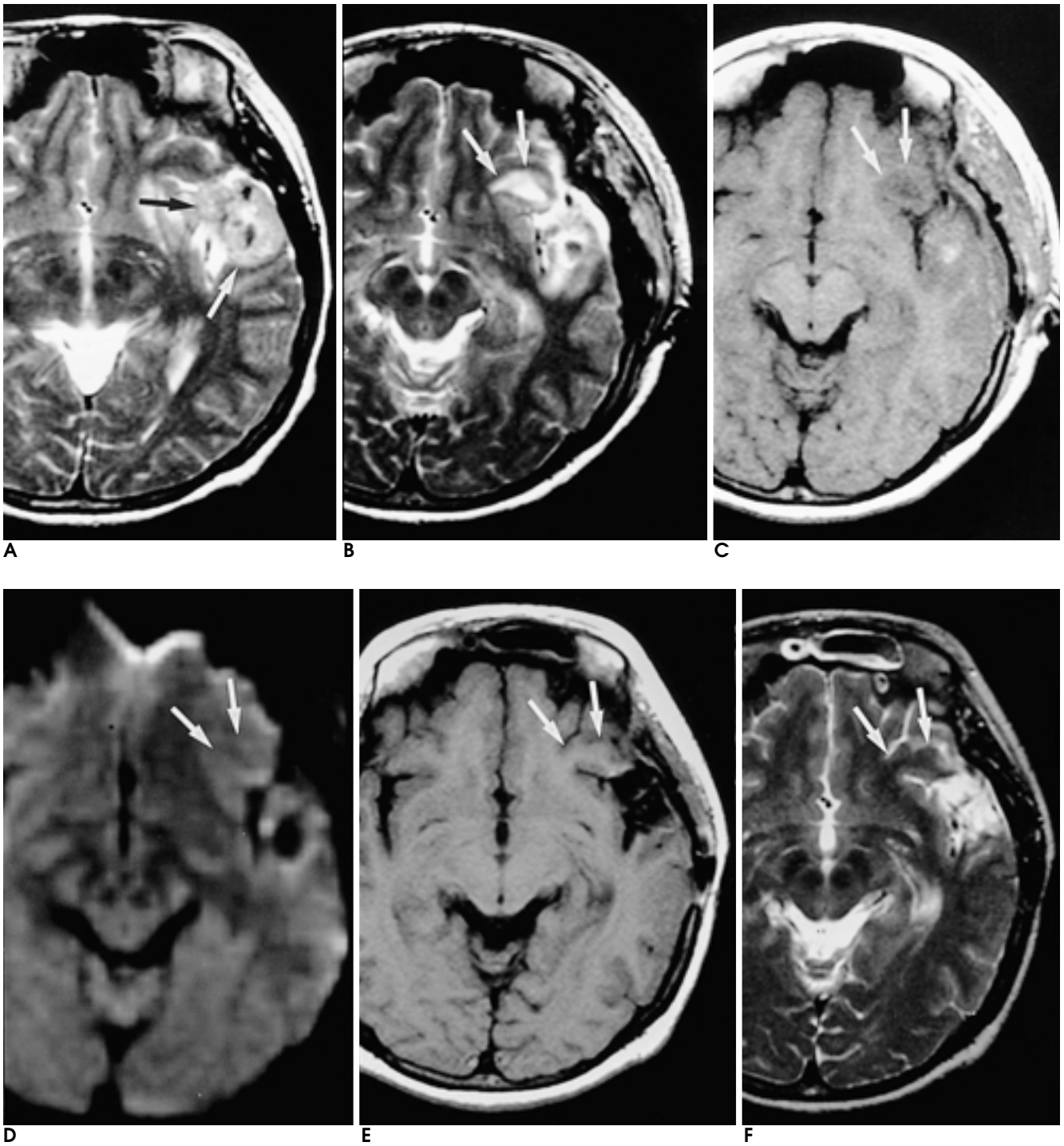


Fig. 3. A 27-years-old female with pleomorphic xanthoastrocytoma in the left anterior temporal lobe.

A. Preoperative T2-weighted image shows a mass in the left anterior temporal lobe (arrows).

B-D. MR images obtained 8 days after tumorectomy. There is newly developed hyperintense lesion in the left basal frontal lobe on T2-weighted image (**B**, arrows). The lesion is hypointense on T1-weighted image (**C**, arrows) and isointense on diffusion-weighted image (**D**, arrows).

E, F. Follow up MR images obtained in 6 months after operation. There is no definite tissue loss in the area of previously developed high signal intensity on postoperative T2- weighted image (arrows).

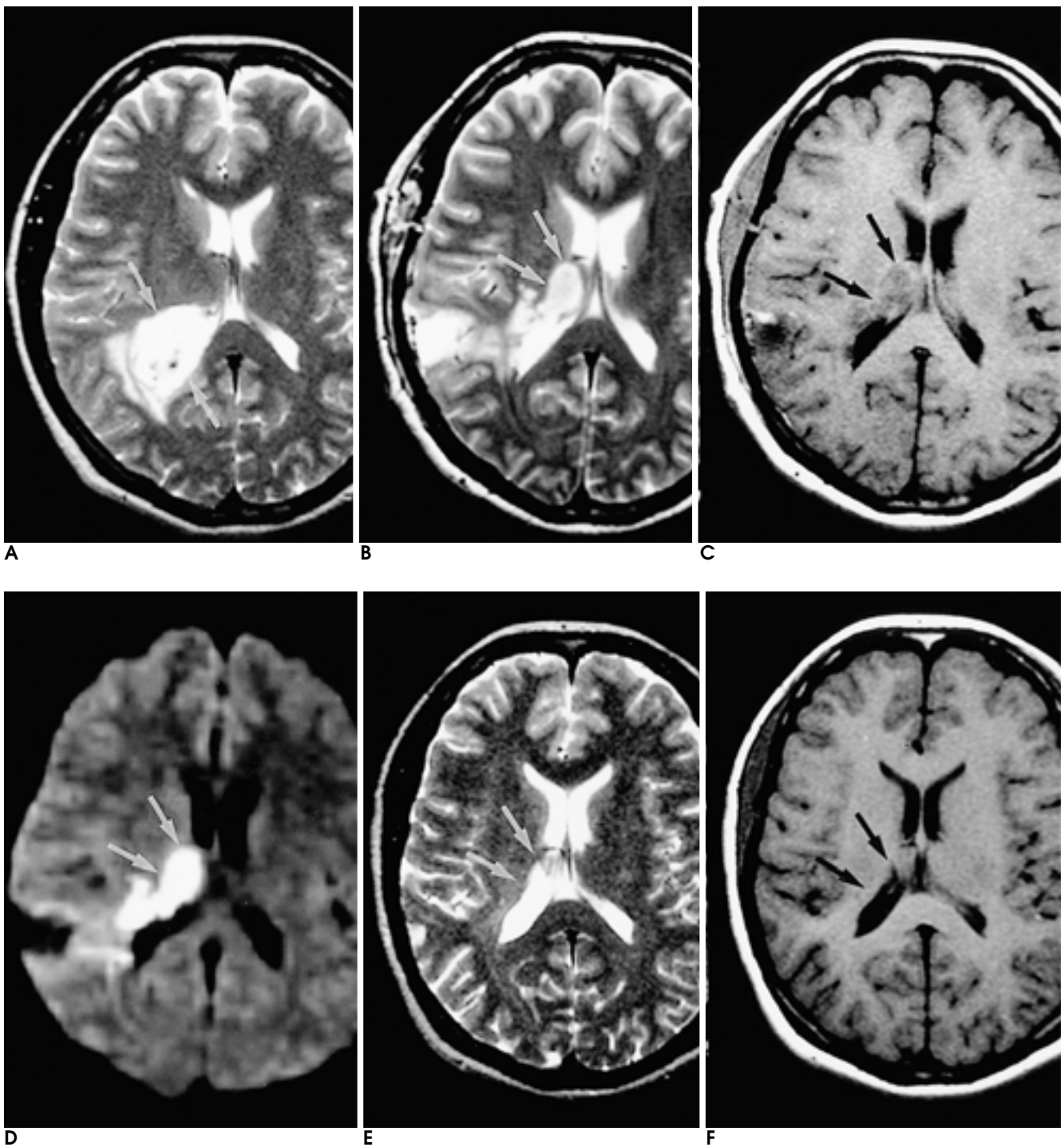


Fig. 4. A 27-year-old male with intraventricular meningioma in the posterior horn of right lateral ventricle.
A. Preoperative T2-weighted image shows a hyperintense mass in the posterior horn of right lateral ventricle (arrows).
B-D. MR images obtained 7 days after operation. Newly developed hyperintense lesion was seen in the right thalamus on T2-weighted image (**B**, arrows). The lesion is hypointense on T1-weighted image (**C**, arrows) and hyperintense on diffusion-weighted image (**D**, arrows).
E, F. Follow up MR images obtained in 6 months after operation. Focal tissue loss is seen in the area of previously developed high signal intensity on postoperative T2-weighted image (arrows).

Table 2. Diffusion-weighted MR Imaging of Newly Developed Lesion at Adjacent Parenchyma after Tumorectomy in 15 Patients

DWI	T2WI	T1WI	ADC value (mean + SD)	Tissue Loss on Follow up
Hyperintense (n = 9)	Hyperintense	Hypointense	$0.53 \pm 0.18 \times 10^{-3} \text{ mm}^2/\text{sec}$	9
Isointense (n = 6)	Hyperintense	Hypointense	$1.55 \pm 0.06 \times 10^{-3} \text{ mm}^2/\text{sec}$	0

T2WI: T2-weighted image

T1WI: T1-weighted image

SD: standard deviation

(21 - 24).

T2 , T1
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T2 가
T1 가
, T2 T1 가
T2
, T1
, T2 T1 T2
,
39 24
, 15
Atlas (25)
MRI
T1
14
T2
T1
가
(26),
T2 가
가
T2
ADC
ADC (0.71 -
(10)
 $0.88 \times 10^{-3} \text{ mm}^2/\text{sec}$ T2
, T2

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Diffusion-weighted MR Imaging after Intracranial Tumor Resection¹

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Purpose: To evaluate the usefulness of diffusion-weighted imaging after intracranial surgery in patients with intracranial tumors.

Materials and Methods: Within ten days of intracranial surgery, diffusion-weighted MR images were obtained in 68 patients with intracranial tumors which included meningioma (n = 31), glioma (n = 21), neurogenic tumor (n = 4), hemangiopericytoma (n = 3), and in three cases involved metastasis. The signal intensity of the resected margin and adjacent parenchyma was visually assessed on diffusion-weighted images, and the signal intensities on seen T1- and T2-weighted images were also analyzed. In patients with newly developed hyperintense lesions in parenchyma adjacent to the resection sites seen on postoperative T2-weighted images, apparent diffusion coefficients (ADC) were calculated and analyzed on follow-up MR images.

Results: Immediate postoperative diffusion-weighted images showed various signal intensities at the resected margins visible on conventional and diffusion-weighted MR images. In 15 patients, newly developed hyperintense lesions adjacent to resected sites were seen on postoperative T2-weighted images. On diffusion-weighted images, nine of these lesions were hyperintense and were shown by follow-up MR imaging to be subject to focal tissue loss and atrophy, and six were isointense but with no sign of tissue loss or atrophy. Among the 15 patients with postoperative lesions near the site of tumorectomy, diffusion-weighted imaging showed that the ADC values of hyperintense lesions were significantly lower than those of isointense lesions (independent sample t-test: $p < 0.05$).

Conclusion: In patients with intracranial tumors, immediate postoperative diffusion-weighted imaging is useful for differentiating between ischemic tissue damage and vasogenic edema.

Index words : Brain, MR

Brain, diffusion

Brain, neoplasms

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