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Table 1. Summary of Fifteen Children with Brain Abnormalities during and after Antileukemic Treatment

Case	Sex	Age* (months)	Type of Leukemia	IT MTX [†]	RT [‡]	Remission	CNS Symptoms	Interval [§]	Radiologic Findings
1	M	100	ALL	+	Cranial	Yes	Dizziness	5 months	Atrophy
2	M	52	ALL	+	Cranial	Yes	No	6 months	Atrophy, Periventricular low density
3	F	114	ALL	+	Cranial	Yes	Mental change	6 months	Intracerebral hemorrhage (Right frontal lobe)
4	F	19	ALL/Lymphoma	+	Cranial	Yes	No	4years	Calcification of basal ganglia
5	M	58	ALL	+	Cranial	Yes	Mental change	1month	Infarction with hemorrhagic transformation
6	F	86	ALL	+	Cranial	Yes	Visual disturbance	1month	Atrophy, Infarction of the territory of posterior cerebral artery
7	M	46	ALL	+	Cranial	No	No	6 months	Atrophy, Normalized after 1year
8	M	122	ALL	+	Cranial	Yes	No	4 months	Focal infarction
9	M	93	ALL	+	Cranial	Yes	No	4 months	Atrophy
10	F	124	ALL	+	Cranial	Yes	No	6 months	Atrophy
11	M	34	ALL	+	Cranial	Yes	No	3years	Calcification of basal ganglia Periventricular low density
12	F	80	ALL	+	Cranial	Yes	Headache	6 months	Atrophy
13	M	81	ALL/CNS Leukemia	+	Cranio-spinal	Yes	No	6 months	Atrophy, Periventricular low density
14	F	63	ALL	+	Cranial	Yes	Nausea/Vomiting	3 months	Atrophy
15	M	83	ALL	+	Cranial	Yes	No	4years	Focal infarction

* Age at diagnosis

[†]Intrathecal methotrexate therapy

[‡]Radiation therapy

[§]indicates the interval from the diagnosis to the time when brain abnormalities were found on imaging studies

ALL: Acute lymphoblastic leukemia

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(Table 1) (Fig. 1 - 5).

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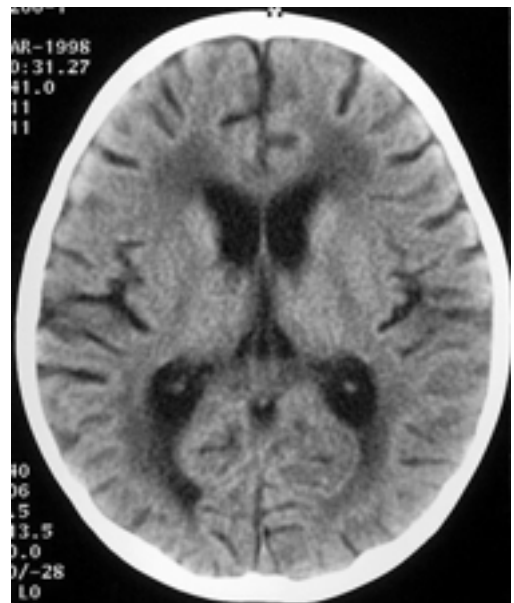


Fig. 2. 6-year-old male patient with acute lymphoblastic leukemia
Precontrast CT scan shows a diffuse hypodensity in the periventricular white matter consistent with periventricular leukomalacia.

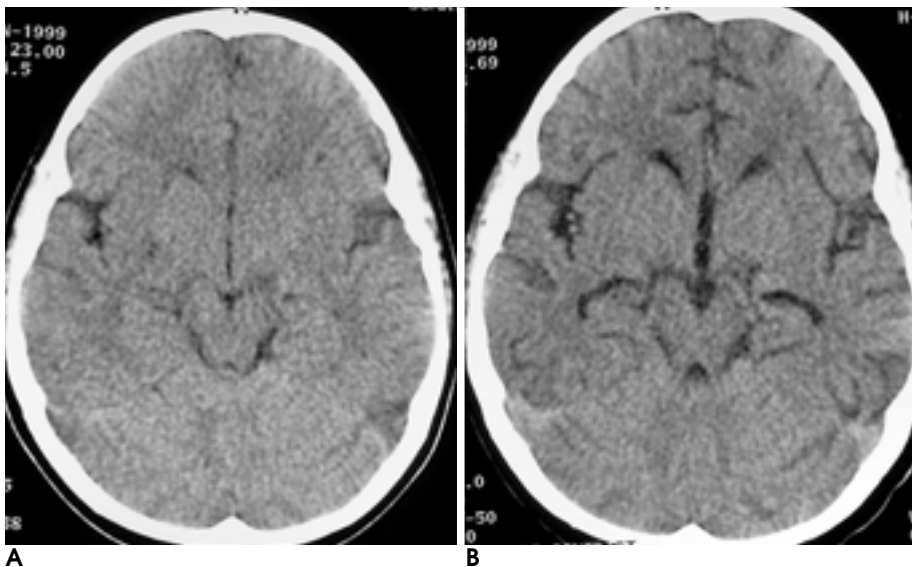


Fig. 1. 8.4-year-old male patient with acute lymphoblastic leukemia
Initial CT (A) scan shows normal brain. Follow-up CT scan (B) 5 months later shows diffuse atrophy.

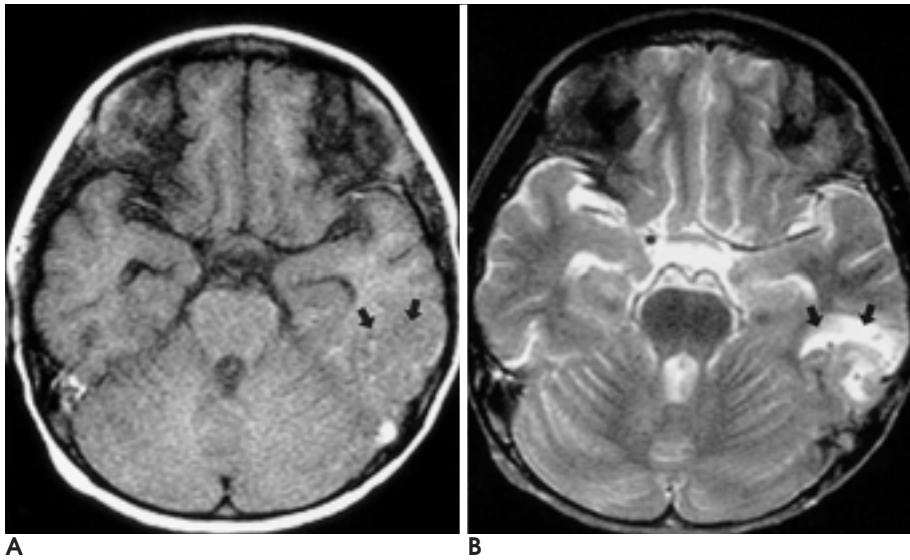


Fig. 5. 4.9-year-old female patient with subacute hemorrhagic infarction which occurred during induction chemotherapy for acute lymphoblastic leukemia

A. Axial T1-weighted MR image shows focal low signal intensity (arrows) mixed with iso-/hyperintensities suggesting a partial hemorrhagic transformation of subacute infarcted area in the left temporal lobe.

B. Axial T2-weighted MR image shows focal gyral hyperintensity (arrows) with mass effect and obliteration of adjacent sulci.

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Imaging Findings of the Brain Abnormalities in Acute Lymphoblastic Leukemia of Children during and after Treatment¹

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Purpose: We evaluated the imaging abnormalities of the brain observed during and after treatment of acute childhood lymphoblastic leukemia.

Materials and Methods: The study group consisted of 30 patients (male: female = 19:11; mean age, 64 months) with acute childhood lymphoblastic leukemia during the previous ten-year period who had undergone prophylaxis of the central nervous system. Irrespective of the CNS symptoms, base-line study of the brain involving CT and follow-up CT or MRI was undertaken more than once. We retrospectively evaluated the imaging findings, methods of treatment, associated CNS symptoms, and the interval between diagnosis and the time at which brain abnormalities were revealed by imaging studies.

Results: In 15 (50%; male: female = 9:6; mean age, 77 months) of 30 patients, brain abnormalities that included brain atrophy (n=9), cerebral infarctions (n=4), intracranial hemorrhage (n=1), mineralizing microangiopathy (n=2), and periventricular leukomalacia (n=3) were seen on follow-up CT or MR images. In four of nine patients with brain atrophy, imaging abnormalities such as periventricular leukomalacia (n=2), infarction (n=1) and microangiopathy (n=1) were demonstrated. Fourteen of the 15 patients underwent similar treatment; the one excluded had leukemic cells in the CSF. Six patients had CNS symptoms. In the 15 patients with abnormal brain imaging findings, the interval between diagnosis and the demonstration of brain abnormalities was between one month and four years. After the cessation of treatment, imaging abnormalities remained in all patients except one with brain atrophy.

Conclusion: Various imaging abnormalities of the brain may be seen during and after the treatment of acute childhood lymphoblastic leukemia and persist for a long time. In children with this condition, the assessment of brain abnormalities requires follow-up study of the brain.

Index words : Leukemia, in infants and children
Leukemia, therapy
Brain, abnormalities

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