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## The lesions in the brains detected by CT scan in the Thai patients Investigated due to seizure.

P. Pekan<sup>1</sup>, P.Sirivongspairat<sup>1</sup>, S.Nirapathapongporn<sup>1</sup>, S.Balachandra<sup>1</sup>,  
C.Chatchavala<sup>1</sup>, K.Osathavanichvongs<sup>2</sup> and R.Vejrak<sup>1</sup>

Retrospective study of the CT scan of the brains of the 931 outpatients who had seizure problems. Fifty five percents showed positive findings. The most common findings of all ages were cysticercosis and the second most common findings were infarction. The third most common lesions were the single mass lesion. Cysticercosis was the most common lesion of the age group 11-40 yrs old, infarct was the most common finding in the age group 41-93 yrs old and brain atrophy was the most common lesion in the age group 0-10 yrs old. The age of the patients ranged from 2 days to 93 yrs old and 75% were 11-60 yrs old. There was a tendency to detect the lesions more in the older ages.

Key words: Seizure, CT scan of the brains

A Seizure is a sudden change in body functioning due to abnormal, excessive electrical discharges of neurons in the brain (1). Epilepsy is a symptom complex in which there is a tendency to have repeated seizures. It follows that not everyone who has seizures has epilepsy, but everyone who has epilepsy has seizures. Neither seizures nor epilepsy is a final diagnosis but a symptom complex requiring a search for underlying etiologic factors. Consideration of seizures should arise whenever a patient presents with loss of consciousness or any sudden brief change in functioning with or without loss of consciousness. Paroxysmal changes in consciousness, sensation, emotion, or through all processes may be manifestations of a seizure disorder. A diagnosis of a seizure disorder is especially likely if such changes are repetitive, stereotyped, and preceded by a premonition or warning (aura) or followed by (postictal) confusion, exhaustion, or headache. The physician's initial task when a patient presents with what might be a seizure is to determine whether the episode was indeed a seizure, or some other episodic, periodic, or recurrent paroxysmal event that is nonepileptic, such as syncope, migraine, pseudoseizure, transient ischemic attack or narcolepsy. When the diagnosis of a seizure is

made, the patient should be evaluated for common toxic-metabolic or structural abnormalities. These commonly include hypoglycemia, infection, alcohol or drug withdrawal, stroke or tumor.

The purpose of the study was to determine the detected structural abnormalities in the brain by CT scan as the causes of seizures in Thai population.

### Materials and methods

Retrospective study of the CT scan of the patients who presented with seizure was performed during the year 1983 and 1991. The CT scan of the brain included plain and intravenous contrast studies. There were 931 patients consisting of 552 male and 279 female patients. The age ranged from 2 days to 93 yrs old. Seizure was the major indication that made the physicians request for the CT scan of the brains in this study. The positive results of the detected lesions were grouped according to the patient's age, as shown in the Table 1-9 and the incidence of each lesion was summarized in Table 10. The patients were sent from many hospitals in Bangkok and outside Bangkok to the diagnostic CT center where the data were

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<sup>1</sup>Department of Radiology, Ramathibodi Hospital, Rama 6 street, Bangkok 10400, Thailand

<sup>2</sup>Medical software development project, Mahidol University, Pin-Klao-Nakornchaisri Street, Bangkok, Thailand

analyzed. The detailed clinical data and the final pathological results would not be obtained. The reported lesions were purely imaging diagnosis by the qualified radiologists.

### Results

From 931 patients, there were 512 positive results which was equal to 55%. The majority of the patients were between 11-60 yrs old, comprising 76%. The rate of the positive detection of the lesions increased with the patient's age. The cystic lesion, ring or nodular enhanced lesions associated with surrounding brain edema of cysticercosis as shown in Fig. 1, was the most common findings in the age group of 11-40 yrs old. Infarct was the most common finding in the age group of 41-93 yrs old. Brain atrophy was the most common finding in the age group of 0-10 yrs old. For overall lesions, infarct was the most common lesion, comprising of 27%, cystic lesions and active cysticercotic lesions were the second

most common lesions, representing 17% each. If the live and dead forms of the cysticercosis were combined, then the cysticercotic lesions were the most common lesions detected by CT scans. These lesions were diagnosed cysticercosis, based on the previous experiences of proved such cases by the operation and the therapeutic treatment. The ring or nodular enlarged lesions were seen as the single lesion at the cortico-medullary area, size were not more than 2 cm, most lesions were near the vertex. The calcified cysticercosis lesions were seen as small rounded dense calcified lesion, size were not more than 2 cm, occurred anywhere in the brains. The 4th most common lesion was single mass, representing 10%. Almost half of them were labelled as meningioma and almost another half were labelled as gliomatous tumors, the rest, few were lipoma of the corpus callosum, acoustic tumor at the CP angle, lymphoma, trigeminal neuroma. Multiple masses were believed to be metastatic lesions. Infarct lesions were usually multiple and small size.

Table 1. Positive lesions by CT scan, No. (%) of each lesion, at the age of 0-10 yrs old.

Lesions	No.	(% of total lesions)
1. Tuberos sclerosi	2	(7)
2. AVM	3	(10)
3. Low density of white matter	2	(7)
4. Subdural or epidural hematoma	3	(10)
5. Intracerebral hematoma	1	(3)
6. Single mass lesion	2	(7)
7. Cyst or ring enhanced or enhanced nodules of cysticercosis	4	(14)
8. Calcified cysticercosis	1	(3)
9. hydrocephalus	1	(3)
10. Brain atrophy	5	(17)
11. Intraventricular cyst	1	(3)
12. Dandy-Walker cyst	1	(3)
13. Abnormal meningeal enhancement	2	(7)
14. Porencephaly	1	(3)
Total	29	(100)

Table 2. Positive lesions by CT scan, No. (%) of each lesion, at the age of 11-20 yrs old.

Lesions	No.	(% of total lesions)
1. brain atrophy	2	(4)
2. Diffuse brain swelling	1	(2)
3. Thickened cortex at both insula	1	(2)
4. Hydrocephalus	1	(2)
5. AVM	1	(2)
6. Low density of the white matter	3	(5)
7. Intracerebral hematoma	1	(2)
8. Single mass	1	(2)
9. Infarct	10	(19)
10. Cyst, ring enhanced or nodular enhanced lesion with surrounding edema	16	(30)
11. Calcified cysticercosis	16	(30)
Total	53	(100)

Table 3. Positive lesions by CT scan, No. (%) of each lesion, at the age of 21-30 yrs old.

Lesions	No.	(% of total lesions)
1. Diffuse brain swelling	1	(1)
2. Brain atrophy	4	(5)
3. Hydrocephalus	4	(5)
4. AVM	8	(10)
5. Low density of the white matter	4	(5)
6. Subdural or epidural hematoma	3	(4)
7. Intracerebral hematoma	5	(7)
8. Single mass lesion	5	(7)
9. Infarct	9	(12)
10. Cyst, ring enhanced or nodular enhanced lesions with surrounding edema	16	(22)
11. Calcified cysticercosis	15	(20)
Total	74	(100)

Table 4. Positive lesions by CT scan, No. (%) of each lesion, at the age of 31-40 yrs old.

Lesions	No.	(% of total lesions)
1. Brain abscess	1	(1)
2. Brain atrophy	4	(4)
3. Thick cortex at both insular areas	1	(1)
4. AVM	2	(2)
5. Subdural or epidural hematoma	4	(4)
6. Intracerebral hematoma	9	(9)
7. Single mass lesion	15	(16)
8. Infarct	12	(13)
9. Cyst, Ring enhanced or nodular enhancement with surrounding edema	25	(27)
10. Calcified cysticercosis	20	(21)
Total	93	(100)



Table 5. Positive lesions by CT scan, No. (%) of each lesion, at the age of 41-50 yrs old.

Lesions	No.	(% of total lesions)
1. Cranial vault destruction	1	(1)
2. Subarachnoid hemorrhage	1	(1)
3. Abnormal meningeal enhancement	1	(1)
4. Diffuse brain swelling	1	(1)
5. Brain atrophy	2	(3)
6. Hydrocephalus	2	(3)
7. AVM	4	(6)
8. Low density of the white matter	1	(1)
9. Subdural or epidural hematoma	4	(6)
10. Intracerebral hematoma	4	(6)
11. Single mass lesion	10	(15)
12. Infarct	17	(26)
13. Cyst, ring enhanced or nodular enhanced lesions with surrounding edema	5	(7)
14. Calcified cysticercosis	13	(20)
Total	66	(100)

Table 6. Positive lesions by CT scan, No. (%) of each lesion, at the age of 51-60 yrs old.

Lesions	No.	(% of total lesions)
1. Subarachnoid hemorrhage	1	(1)
2. Abnormal meningeal enhancement	1	(1)
3. Intraventricular hemorrhage	1	(1)
4. Hydrocephalus	3	(3)
5. AVM	4	(4)
6. Low density of the white matter	1	(1)
7. Subdural or epidural hematoma	1	(1)
8. Multiple masses	2	(2)
9. Intracerebral hematoma	8	(9)
10. Single mass	9	(10)
11. Infarct	28	(30)
12. Cyst, ring or nodular enhanced lesions with surrounding edema	17	(18)
13. Calcified cysticercosis	16	(18)
Total	92	(100)

Table 7. Positive lesions by CT scan, No. (%) of each lesion, at the age of 61-70 yrs old.

Lesions	No.	(% of total lesions)
1. Intraventricular hematoma	1	(2)
2. Calcification of the basal ganglia and dentate nucleus	1	(2)
3. Hydrocephalus	2	(3)
4. Low density of the white matter	1	(2)
5. Subdural or epidural hematoma	2	(3)
6. Multiple masses	1	(2)
7. Intracerebral hematoma	3	(5)
8. Single mass	7	(12)
9. Infarct	31	(54)
10. Cyst, ring or nodular enhanced lesions with surrounding edema	4	(7)
11. Calcified cysticercosis	4	(7)
Total	57	(100)

Table 8. Positive lesions by CT scan, No. (%) of each lesion, at the age of 71-80 yrs old.

Lesions	No.	(% of total lesions)
1. Aneurysm	1	(3)
2. Hydrocephalus	1	(3)
3. AVM	1	(3)
4. Low density of the white matter	1	(3)
5. Subdural or epidural hematoma	1	(3)
6. Intraventricular hemorrhage	3	(8)
7. Single mass lesion	4	(11)
8. Infarct	18	(51)
9. Cyst, ring or nodular enhanced lesions without surrounding edema	1	(3)
10. Calcified cysticercosis	4	(11)
Total	35	(100)

Table 9. Positive lesions by CT scan, No. (%) of each lesion, at the age of 81-93 yrs old.

Lesions	No.	(% of total lesions)
1. Hydrocephalus	2	(12)
2. Multiple masses	1	(5)
3. Intracerebral hematoma	1	(5)
4. Infarct	12	(70)
5. Cyst or ring or nodular enhanced lesion with surrounding edema	1	(12)
Total	17	(100)

Table 10. Number of each lesion compared with the total lesions detected by CT scan, in all age groups.

Lesions	No.	(% of the total lesions)
1. Calcified cysticercosis	89	(17)
2. Cyst, ring enhanced or nodular enhanced lesions with surrounding edema	89	(17)
3. Infarct	137	(27)
4. Intracerebral hematoma	32	(6)
5. Subdural or epidural hematoma	18	(3)
6. Hydrocephalus	16	(3)
7. Multiple masses	4	(1)
8. Single mass	53	(10)
9. Aneurysm	1	(0.2)
10. AVM	23	(4)
11. Low density of white matter	13	(2)
12. Intraventricular hematoma	2	(0.4)
13. Calcification of the basal ganglia and dentate nucleus	1	(0.2)
14. Subarachnoid hemorrhage	2	(0.4)
15. Abnormal meningeal enhancement	4	(1)
16. Cranial vault destruction	1	(0.2)
17. Diffuse brain swelling	4	(1)
18. Brain atrophy	17	(3)
19. Brain abscess	1	(0.2)
20. Thick cortex at both insular areas	2	(0.4)
21. Intraventricular cyst	1	(0.2)
22. Dandy-Walker cyst	1	(0.2)
23. Porencephaly	1	(0.2)
24. Thickened cortex at both insula	2	(0.4)
Total	512	(100)

Table 11. Incidence of positive CT scan in each age group and in all ages

Age group	Total pts in gr. (% of total pts)	No. % of group of lesions		% of total positive patients
		No.	%	
0 - 10	84 (9)	29	34	6
11 - 20	149 (16)	53	35	10
21 - 30	154 (16)	74	48	14
31 - 40	147 (15)	93	63	18
41 - 50	131 (14)	66	50	13
51 - 60	138 (15)	92	67	18
61 - 70	64 (6)	57	90	11
71 - 80	45 (5)	35	78	7
81 - 93	19 (2)	17	89	3

Total patients were 931, total positive patients were 512



### Discussion

The normal CT findings in the patients with seizure was seen in 45% of 931 patients which is slightly lower than the reports of McGahan (60%) (2) and of Bogdanoff (64%) (3).

The small calcified nodules (assumed calcified cysticercosis) cysts of cysticercosis and ring or nodular enhanced lesions with surrounding edema (assumed just dead cysticercosis) were the most common lesions of overall lesions. Thailand is known as one of the endemic area of cysticercosis, so that these lesions were not mentioned in the reports of McGahan or of Bogdanoff. These lesions were also presented in the age group 0-10 yrs old, shared the first rank with the brain atrophy. The overall incidence was 34% of the total lesions.

Infarction was seen as the most common lesion for the age 61-93 yrs old and was the 2nd most common lesion for the age 11-30 yrs old and 41-60 yrs old. It was the third most common lesion for the age 31-40 yrs old. The overall incidence was 27% of the total lesions. It was seen 15% of the detected lesions reported by McGahan (2). In the McGahan's report, the infarct lesion was not seen in the patient younger than 45 yrs old. There was no infarct lesion in Bogdanoff's report (3)

The single mass lesion was the third common lesion of the overall lesions and was the second most common lesion for the age 31-40 yrs old. It was seen in 10% of all positive lesion by us, 10% by McGahan (2) and 11% by Bogdanoff (3). However, both authors included every kind of neoplasm. If we included multiple

masses lesion, the incidence would be 11% of the overall lesion.

Bachman et al (4), reported CT scan in chronic seizure disorders of childhood in 98 children of age 3 months to 20 yrs old. Seventy one percents were normal scans and brain atrophy was the most common lesion seen in 46%. We found 82 positive cases in 233 patients, the negative findings was 65% and brain atrophy was the third most common lesion comprising of 8%. The most common lesion was cysticercosis, seen in 39% and infarct the second most common lesion representing 12%. There were no cysticercotic or infarct lesion by Bachman's study, except for 11% post-op changes.

There was a tendency to increase incidence of the detection of the lesion with advancing age, similar findings as that of Zimmerman (5). The detection rate was 34-48% at age 0-30 yrs old, 50-67% at age 31-60 yrs old and 78-90% at age 61-93 yrs old.

MRI of the brain might detect the temporal lobe lesions, such as focal temporal lobe atrophy, small gliomas, hamartomas, heterotopias, cavernous angiomas and arteriovenous malformation as the causes of seizure better than CT scan (6-9). However, in Thailand, where the calcified cysticercosis are quite common, CT scan is still needed in the investigation of seizure, because MRI cannot detect calcification well.

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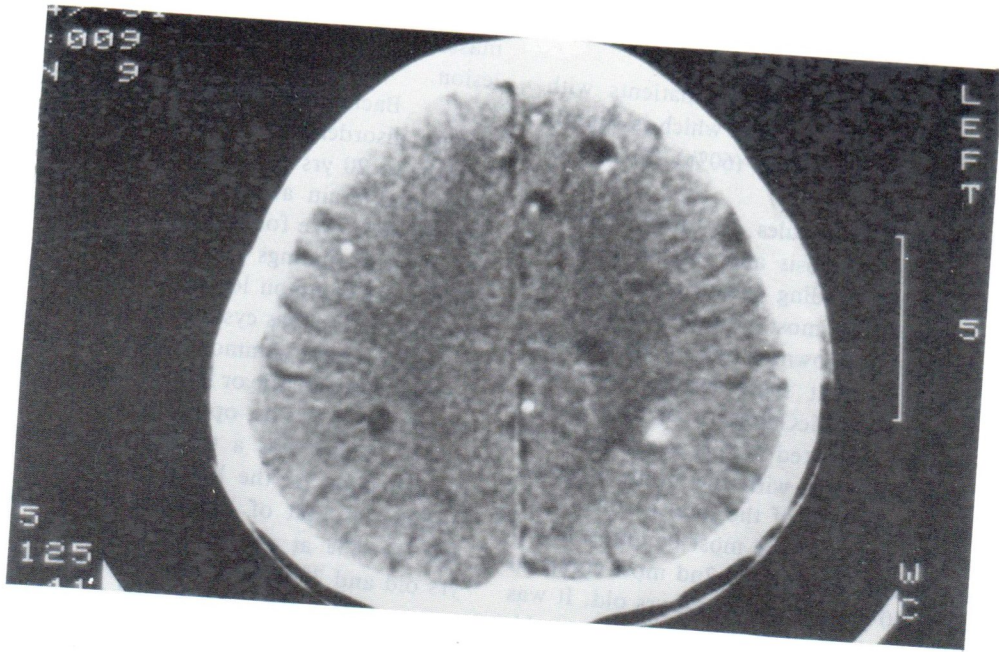


Fig. 1a Cysticercosis. Non i.v. enhanced CT scan of the brain, supraventricular level showed small calcified nodules, small cystic lesions with and without calcified scolex at both frontoparietal lobes.

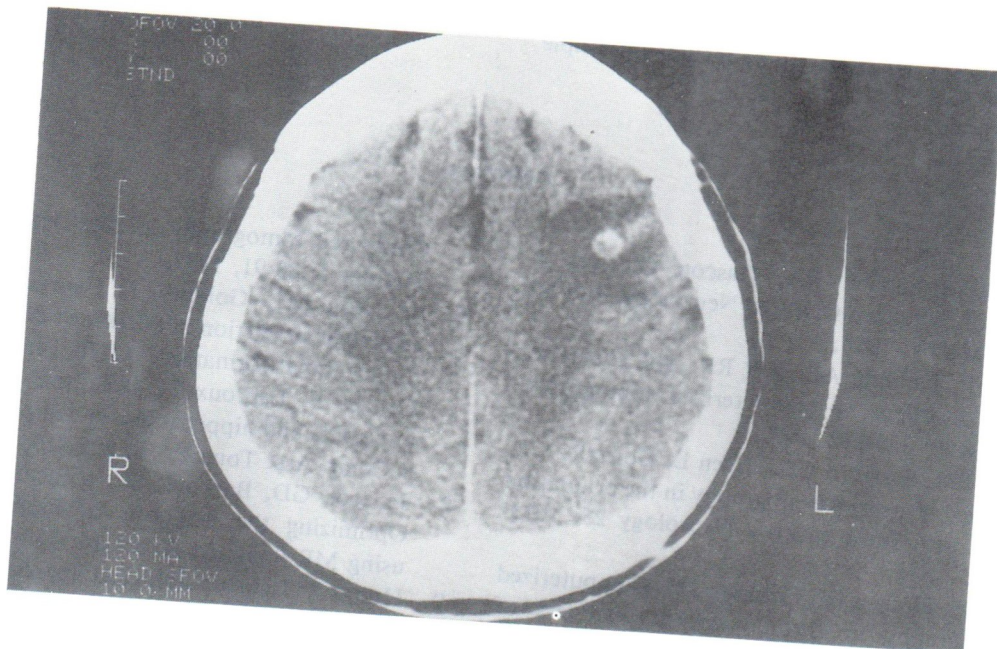


Fig. 1b Cysticercosis. I.V. enhanced axial CT scan of the brain, supraventricular level showed small ring enhanced lesion with surrounding white matter edema at corticomedulullary area at high Lt. frontoparietal lobe. Just-dead cysticercotic lesion.