# Lennox-Gastaut Syndrome

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(Received March 9, 1977)

## INTRODUCTION

Lennox-Gastaut syndrome in parellel with West syndrome belongs to and accounts for the bulk of so-called intractable epilepsy in little children.

Organic disturbance of the central nervous system is taken as the possible cause, but physiological eluciation of the pathological state of this syndrome is still from being satisfactory.

Epilepsy seen in little children is varied in the type of seizure.

Moreover, the type of seizure also changes with age and the pathological patterns are not uniform from one age group to another. This is one of the characteristics of infantile epilepsy.

In addition, impairment of intelligence is found in almost all cases of intractable epilepsy, and continuation of fits further adds to devastation of intelligence, which leads to miserable results.

Neuropathologically, epileptic encephalopathy is said to be observed.

We would like to stress that making efforts for early detection and early treatment of this disease is one of the major tasks imposed on us.

## CASE REPORT

10 years and two months old boy

Family history: None of his blood relatives has psychosis and neurological disorders. His parents are living and well.

He has two elder sisters, each attending a senior high school and junior high school; their grades are of the average or middle of the class. Not even once have they had convulsive attack. A child between his second elder sister and himself was aborted spontaneously.

Delivery was easy at full term; the body weight at birth was 3,300g. The physiological jaundice was mild; growth thereafter by breast-feeding was smooth physically and mentally, and he started walking at 11 months after birth. Compared with elder sisters, he is said to have started talking earlier.

There came the first seizure ··· with the whole body stiffened, he would not reply, when called ··· at one year and six months. Retardation in intelligence has since become conspicuous.

Present illness: While he was playing on a desk at one year and six months, there appeared a seizure in which he suddenly stopped moving and with his eyes upped, he would not show any response to a call.

This is the first seizure. Since then similar seizure had occurred frequently and he came to fall unconscious. So, he had a medical examination and started taking medications, but no improvement was seen in the seizure of moving his eyes upward and seizure of falling and getting limbs stiffened. He appeared to be seized with the attack for 5 to 6 times a day or more on some days.

However, seizure at night disappeared after the medication was initiated.

Since the appearance of the seizure, the development of intelligence has been delayed markedly, and speaks only a few words such as "go-han" (rice), "o-cha" (tea) and "o-shinko" (pickles) and cannot use any verbs.

Appears right-handed, but he tries to eat with the chopsticks held in the left hand.

As to urination and defecation, he can almost take care of himself. As for putting on and off of the clothing, he can do it only for underwear.

He cannot button up or off, nor can he fasten or unfasten a belt for a trouser by himself.

Due to the intelligence being retarded, entrance into an elementary school was postponed for a year, and he entered a nursery school, being in the 3rd year student there at present.

Seizure occurs frequently almost every day.

It consists mainly of fixation of the eyeballs which lasts 3 to 5 seconds, upward shifting of the eyeballs, the neck bent forward and the hands extending to the mouth or nose. There sometimes is seen seizure in which the whole body becomes rigid.

Administration of nitrazepam was of no avail.

Even when valproic acid 600 mg, acetazolamide 750 mg and sulthiame 600 mg were administered each in a daily dose, the seizure would not disappear.

Such a seizure occurs 4 to 5 times a day and 7 to 8 times at the most.

According to a health nurse, the seizure occurs relatively often sometime between 1 p.m. and 6 p.m.

The patient was admitted to the Department of Neuropsychiatry Yamaguchi University School of Medicine for medical examination.

Findings on admission: While the consciousness appears to be clear, the patient is quite restless, moving around incessantly and will not show any responce to the call of doctors and nurses.

No interest is shown in illustrated books and toys.

Even when an illustrated book is placed in his hands, he just turns the pages in a stereotype manner.

In good humor, he at times put on a smile like a feigned smile not matching the surrounding situation.

But he does not utter even a word and is not cooperative with the medical examination.

According to the results of the type K infant development test, he is shown to have development equal to that of one year and a half or two years old infants.

Neurological findings: The face is symmetrical; no deformity in the head is shown on palpation; the face and head show no scar.

The tongue and uvula show no evidence of abnormality.

The pupils are medium in size, equal and regular, reacting fast and fully to light.

Ocular movements are not limited, nor is there nystagmus. Reaction to accommodation, though not definite, appears to be maintained.

Physiological tendon reflex is normal, there being no difference between the right and left.

Abdominal reflex is normal with no difference between the right and left. No pathological reflexes are noted. There is no nuchal rigidity. Findings of the heart and lungs showed no evidence of abnormality, the blood preasure reading being 100/60 mmHg.

Laboratory examinations: Albumin showed somewhat low value at 3.1 g/dl, thus resulting in A/G ratio of 0.82.

Alkaline phosphatase was high at 240 u, otherwise showing no abnormality.

Serum electrolytes: Sodium 144 mEq/1, potassium 3.4 mEq/1, chloride 109 mEq/1, bicarbonate 22 mEq/1, inorganic phosphorus 3.1 mEq/1 protein 16 mEq/1, total calcium 4.6 mEq/1.

Examination on peripheral blood revealed normocytic normochromic anemia with neutropenia and lymphocytosis.

Electroencephalographic examination: Electroencephalographic examination was performed for twice during admission.

Since the patient was hyperkinetic and not cooperative with the examination, a sleeping EEG was done.

The first electroencephalogram was recorded on the 3rd hospital day. No anticonvulsants were administered.

On the 2nd hospital day an attempt was made to perform the examination by administering monosodium trichlorethyl phosphate 2000 mg, but no examination could be carried out since the patient did not go to sleep.

Then, intramuscular administration of chloropromazine 12.5 mg and promethazine 12.5 mg was conducted for twice the same day, after which the examination was performed.

One and a half hour after the injection, the patient went to sleep for a short time and moved to sleep stage II.

Paroxysmal bilateral synchronous 2-2.5 Hz polyspike-and-wave and spike-and-wave complex were noted in all leads, being predominent particularly in the fronto-centro-occipital area.

This paroxysm appeared very frequently, lasting 1 to 5 seconds.

The site and shape of lump showed no abnormality (Fig. 1).

Second electroencephalographic examination was performed on the 17 th hospital day.

As with the first examination, no anticonvulsants were administered.

Since oral administration of pentobarbital 100 mg failed to induce sleep, the patient was given intramuscular injection of chlorpromazine 25 mg and promethazine 25 mg together; the patient went to sleep about one hour after, whereupon the examination was done.

Records of this examination also revealed paroxysmal bilateral synchronous 1-2 Hz polyspike-and-wave complex in all leads, and they appeared predominently in the fronto-centro-occipital area in particular.

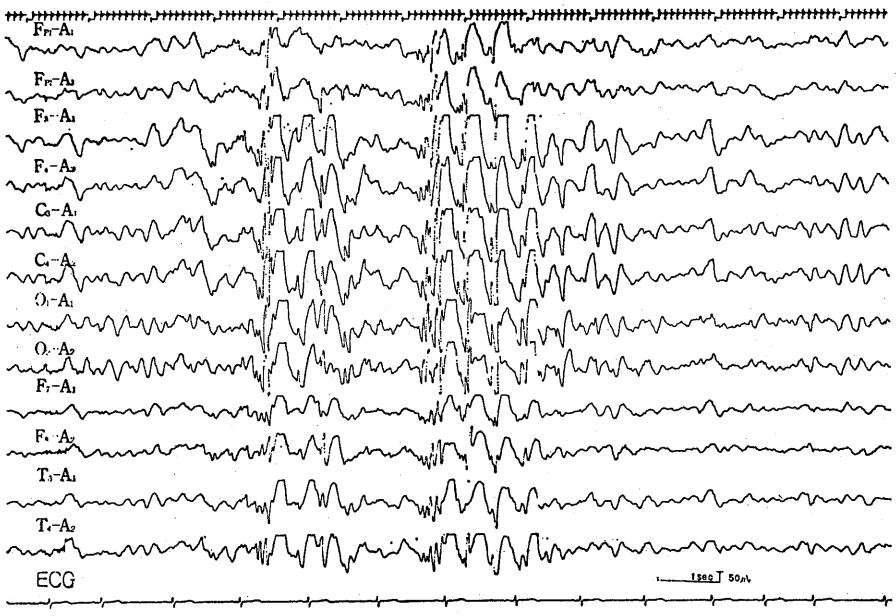


**Fig. 1** 2–2.5 Hz poly spike-and-wave complex appeared in all leads. Paroxysm appeared predominently in the fronto-centro-occipital area,lasting two to four seconds.

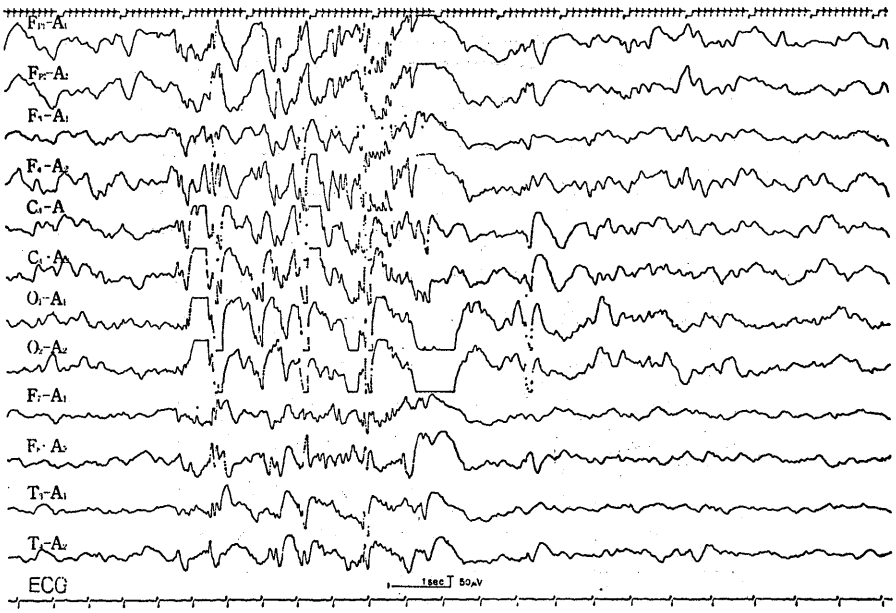


**Fig. 2** Paroxysmal bilateral synchronus 1–2 Hz poly spike-and-wave complex appeared in all leads.

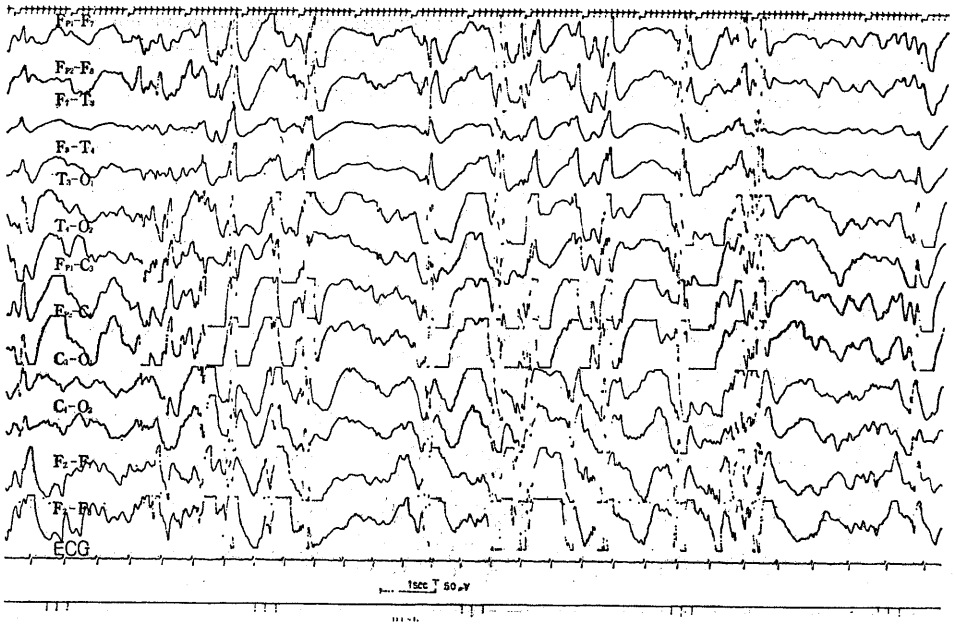


**Fig. 3** Findings suspected of phase reversal are observed in bipolar lead, between $F_{p1}$–$C_3$ and $C_3$–$O_1$, between $F_{p2}$–$C_4$ and $C_4$–$O_2$.

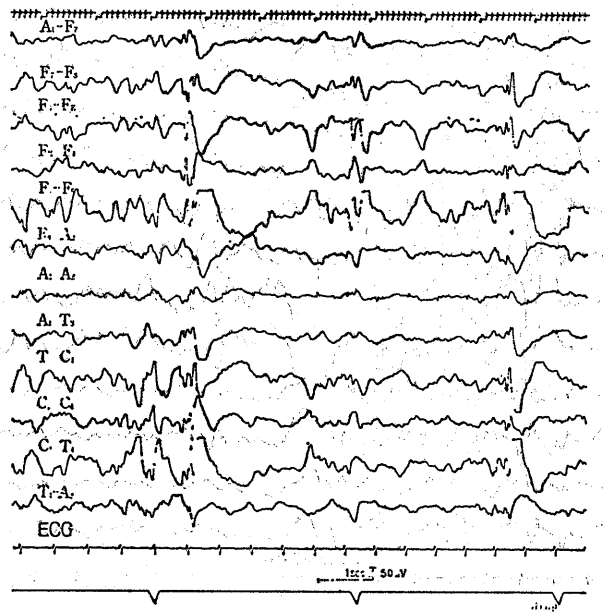


**Fig. 4** Phase reversal between $F_3$–$F_2$ and $F_2$–$F_4$ and between $T_3$–$C_3$ and $C_4$–$T_4$.

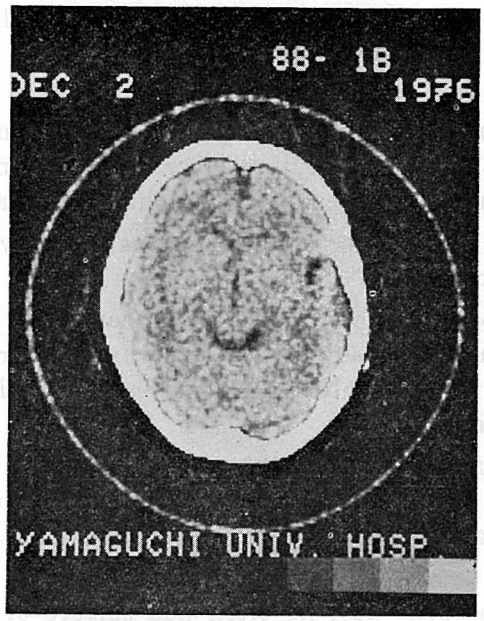


Fig. 5 CTAT pattern. Findings suspected of brain atrophy centering around the anterior end of right temporal region are observed.

This discharge appeared frequently, lasting 1 to 10 seconds. There also is observed what Ohtahara[5] calls rapid rhythmlike paroxysm (Fig. 2)

In bipolar lead, there was noted the phase reversal between $Fp_1$-$C_3$ and $C_3$-$O_1$ and between $Fp_2$-$C_4$ and $C_4$-$O_2$ (Fig. 3).

Furthermore, there was a finding suspected of the phase reversal between $F_3$-$F_2$ and $F_2$-$F_4$ and between $T_3$-$C_3$ and $C_4$-$T_4$; this is a finding which can be taken as centrencephalic phase reversal (Fig. 4).

Results of CTAT: There were obtained results suggestive of atrophy of brain parenchyma centering around the anterior end of the temporal lobe on the right (Fig. 5).

Clinical course after admission:

We made confirmation of the type of seizure up to the 26 th day after admission without administering anticonvulsants.

In the ward he was restless and walked around the corridor; he took meals by himself but while at meal, he often stopped eating half way and started loitering around. When his eyes met the eyes of a nurse, he would smile, but "shikko" (pee) was the only spontaneous speech.

On the day of admission, we confirmed a seizure for once where

the patient stopped suddenly while walking, got the eyeball turned upward, dropped a magazine he carried on the floor, kept standstill for about 30 seconds and suddenly started moving again.

On the second day, the patient was absent-mindedly sitting in a chair all day due partly to injection of chloropromazine and promethazine given in preparation for encephalographic examination.

On the third day, he got used to the ward and was running around raising a queer voice, "Ah".

In taking a bath he needed a helping hand.

During a meal there were observed several seizures lasting 2 to 5 seconds in which he suddenly bends his head forward. Thereafter seizure was hardly noted.

He showed acts such as thrusting his hands into a wastebasket and scattering trashes all around on the corridor, taking out personal effects of other patients and urinating at the corner of the ward. He was prone to be sleepless.

On the 5 th hospital day, he often had seizure of opening the eyes widely and staring at something and seizure of inclining his head to the right or bending his head forward followed by two consecutive spastic seizures where the limbs become rigid with clonic convulsions.

From the 26 th day, oral administration of valproic acid in a daily dose of 800 mg was initiated.

At the first week after initiation of the administration, an attempt was made to perform encephalographic examination, but the patient was so restless that the electrodes could not be fit and after all no examination could be done.

On the 14 th day, therefore, encephalographic examination was carried out after intramuscular injection of chlorpromazine 5 mg and promethazine 25 mg and oral administration of pentobarbital 200 mg as with the second EEG.

Results were quite the same as those of the first and second electroencephalographic examinations, with diffuse slow polyspike and wave complex appearing frequently. That is, no improvement whatsover was observed in EEG despite clinical seizure having disappeared completely.

With no seizure noted thereafter, the patient was discharged on the 82 nd hospital day.

At present, the patient is on valproic acid 800 mg and under observations for the clinical course.

## DISCUSSION

Groups of diseases classified as Lennox-Gastaut syndrome or Lennox syndrome develop mostly between the ages of 2 and 8 years or rarely in adolescents. There underlies encephalopathy of which cause is unknown, and clinically they show a combination of symptoms as follows. 1) Tonic seizure, atonic seizure and atypical absence (occurring alone or together, or sometimes in combination with other types of seizure), 2) EEG shows interictal diffuse slow spike-and-wave discharge, 3) mental retardation and radiological signs of cerebral atrophy are observed as defined by Gastaut (1973)[1].

The slow spike-and-wave characteristic of this syndrome is called petit mal varient (Gibbs, Gibbs and Lennox, 1939)[2] and was differentiated from 3 c/s spike-and-wave seen in petit mal.

This syndrome was named Lennox syndrome against such a historical background.

It is Gastaut et al. (1966)[3] that made these characteristics on EEG records correspond to specific clinical pictures. Today, therefore, it is treated as Lennox-Gastaut syndrome (Niedermeyer 1969)[4].

As underlying diseases, mention can be made of cerebral infantile paralysis, sequelae of West syndrome, sequelae of encephalitis and tuberous sclerosis.

Besides, there are many spontaneous diseases.

Thus, this syndrome is deemed as being of polyetiology (Otahara, 1975)[5].

If viewed from underlying diseases, this syndrome is assumed to be common or akin to West syndrome.

Gastaut and Gastaut (1976)[6] conducted the CTAT examination on Lennox-Gastaut syndrome patients and reported that focal or diffuse lesion was found in 60 per cent of these patients and that the proportion there of was higher than in West syndrome.

They further stressed the usefulness of CTAT by citing global cortical/subcortical atrophy, hemispheric cortical/subcortical atrophy, lobar cortical/subcortical atrophy, porencephaly, parieto-occipital tumor, blastomate (Bourneville), locoblastic infiltrate, cerebral area of calcification, focal lesion-type-unknown.

The type of seizure identified in this case was composed mainly of tonic spasms in which the patient becomes rigid over the entire body, bends the head forward and has the eyeballs turned, and further this

was complicated with tonic seizure and atypical absence.

These types of seizure are said to appear whether the patient is awake or asleep. According to our observations, no definite seizure at night is confirmed.

Meanwhile, observations by the stuffs at the nursery where the patient is admitted stress that the seizure ooccurs frequently in the afternoon. Elucidation of this point is a subject for future studies.

Referring to the relationship between the pattern of atrophied brain identified by CTAT and findings of phase reversal on EEG on the one hand and Lennox-Gastaut syndrome on the other, it cannot be ruled out that the presence of brain atrophy has something to do with the onset of this disease as defined by Gastaut.

Yet, the pathological substance of it has not been clarified.

While this disease is very difficult to treat, compounds of the benzodiazepine group (Liske et al. 1963[7], Jong, 1964[8], Takeshita et al. 1968[9] and ACTH therapy are said to be effective to some extent.

Also, valproic acid and ethosuximide are somewhat effective for atypical absence and myoclonic absence (Otahara, 1975[5]).

Recently, there have been reports on the therapeutic experience with clonazepam for this disease (Bergamini et al. 1970[10], Aarli, 1973[11], Balaasa et al. 1973[12], Birket-Smith et al. 1973[13], Higano et al. 1975[14], Hara et al. 1976[15]).

Lennox-Gastaut syndrome in parallel with West syndrome is a disease which accounts for the major part of intractable epilepsy peculiar to childhood; since it is accompanied by impairment of intelligence, early treatment of it is an urgent problem.

Investigation into the pathological substance of this disease should also be made early.

## SUMMARY

Reported here is a boy aged 10 years and two months who presented Lennox-Gastaut syndrome.

There were identified diffuse polyspike-and-wave on EEG and tonic spasm, tonic-seizure and atypical absence clinically.

CT scanning revealed a pattern suggestive of atrophy of the right temporal region.

Administration of valproic acid produced some therapeutic effects.

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