
症 例

A Case with the "Projected" EEG Disturbances due to Minute Unilateral Epileptic Focus

by

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INTRODUCTION

We recently had a case in which very small pathological changes were ascertained at the left posterior parietal region at operation and patient's preoperative electroencephalograms disclosed bilateral spike discharges on both left and right parietal regions. It is widely known that in clinical and experimental situations, the transmitted paroxysmal discharges from the original focus are not infrequently observed at the homologous area of the opposite hemisphere, but the fact that even such a minute cortical unilateral pathology as this case having gliosis in the range of 1 square centimeter, can also on occasion give rise to the discrete secondary (or mirror) focus in EEGs, is not so well recognized. It is the purpose of this paper to report a case we have experienced and the effect of intracarotid injection of sodium amytal on the secondary discharges.

CASE REPORT

A 8-year-old girl had been suffered from tonic clonic convulsions since the age of seven, and occasionally masticatory movements had been observed during her attacks. Attacks were nocturnal and no episode had been noticed during periods of wakefulness.

At admission, no abnormality was found on neurological examinations including pneumoencephalogram and left carotid angiogram. Past history was nothing particular and birth was considered normal.

Several preoperative electroencephalographic examinations showed an area of almost continuous slow activity in the left Sylvian region having precisely localized focus with spike and sharp waves. Seizure discharges were also recorded from the homologous area of the opposite hemisphere. As shown in Fig. 1, spike amplitude in the left focus was higher as compared with that in the right and right sided spike discharges were always preceded by the spikes from the left side. Exact temporal relations between spike discharges in the primary and mirror area were calculated approximately 15 to 20 msec. Because of these clear differences between the characteristics of electrical discharges on the two sides, identification of the dominant focus could readily be made in this case. Presence of localized slow activity was also helpful to deciding the primary region.

As shown in Fig. 2, seizure discharges increased in frequency during period of slow

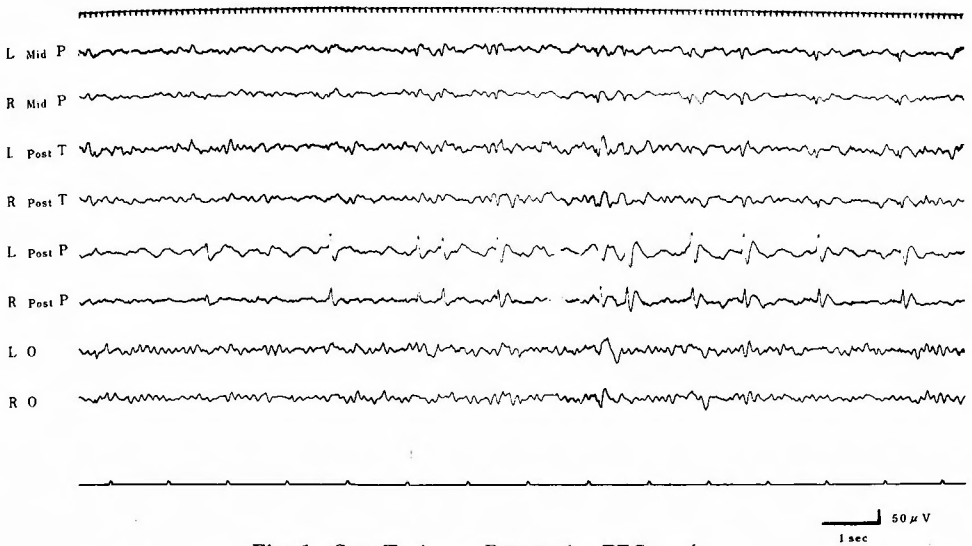


Fig. 1 Case T. A. Preoperative EEG awake

wave sleep. In contrast, appearance of spikes at the dominant focus and their transmission to the opposite side were somewhat reduced during period of wakefulness. Burst of spike recorded during wakefulness was not so remarkable as compared with that recorded during sleep and not all spikes from the primary focus were transmitted to the opposite side so that some spikes appeared without any association with the discharge of the secondary focus.

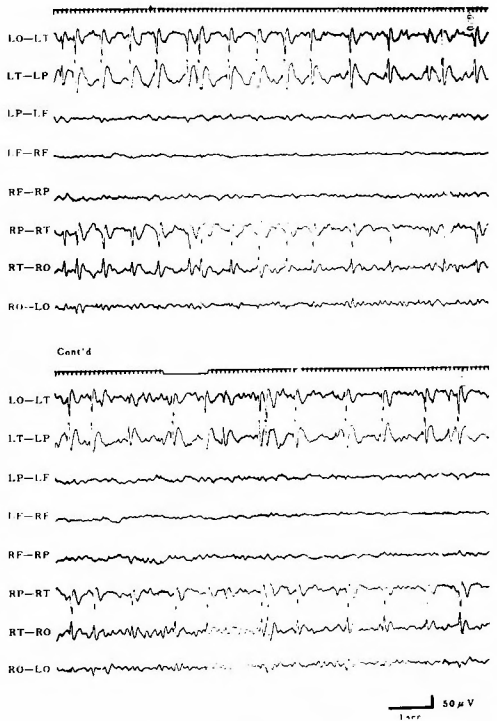
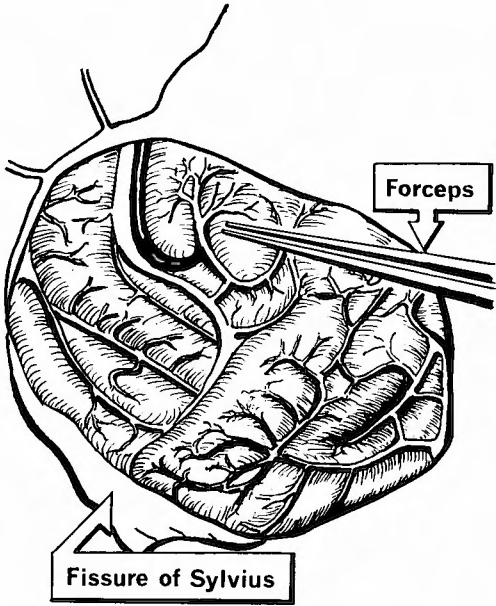


Fig. 2 Case T. A. Preoperative EEG light sleep

Operation was performed under general anesthesia using gas, oxygen and fluothne and moreover, small amount of phenobarbital was used when endotracheal intubation was carried out, mainly because patient was too young to endure for a long time procedure and patient's co-operation could not be expected at all.

As soon as the dura was opened, abnormal whitish gyrus was noticed on inspection just above the posterior portion of the fissure of Sylvius and this gyrus was hard and resistant to palpation as shown in the photograph. This circumscribed area ascertained at the operation, was limited in the range of 1 cm square and as shown in Fig. 3, burst of spike discharges was observed (the electrode # 3 and 4) at this confined area and dotted circle schematically represents the area which showed abnormal findings. Fig. 4 illustrates weak afterdischarge activity

Sketch of Operative Procedure



Forceps have been attached to the area which showed abnormal findings.

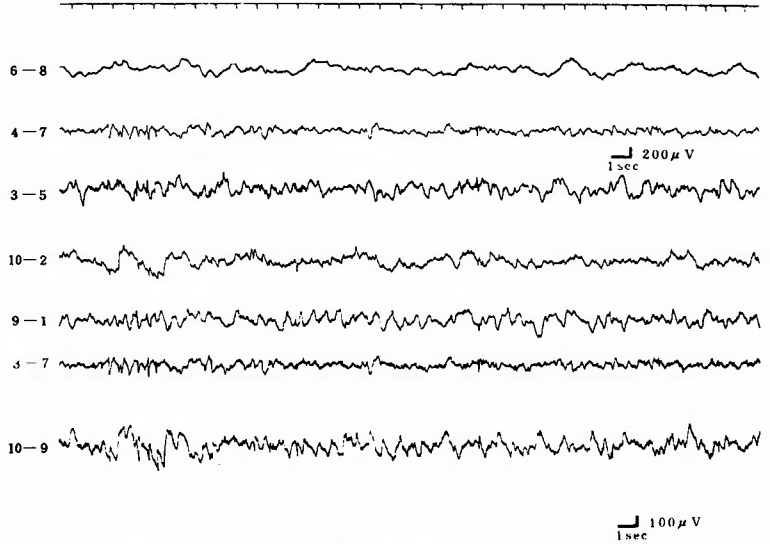
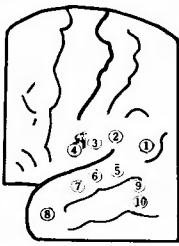


Fig. 3 Case T. A. ECG during operation

provoked by high frequency electrical stimulation applied to this abnormal cortical surface and these electrical findings could be obtained under such conditions that anesthesia was temporarily discontinued and patient's movements were controlled by injecting succinyle choline chloride. Soon after the introduction of anesthetic gas, spontaneous spike discharge disappeared completely. Although topical application of 1% ACh solution to the cortical surface under light anesthesia produced sporadic spike discharges similar to that seen under

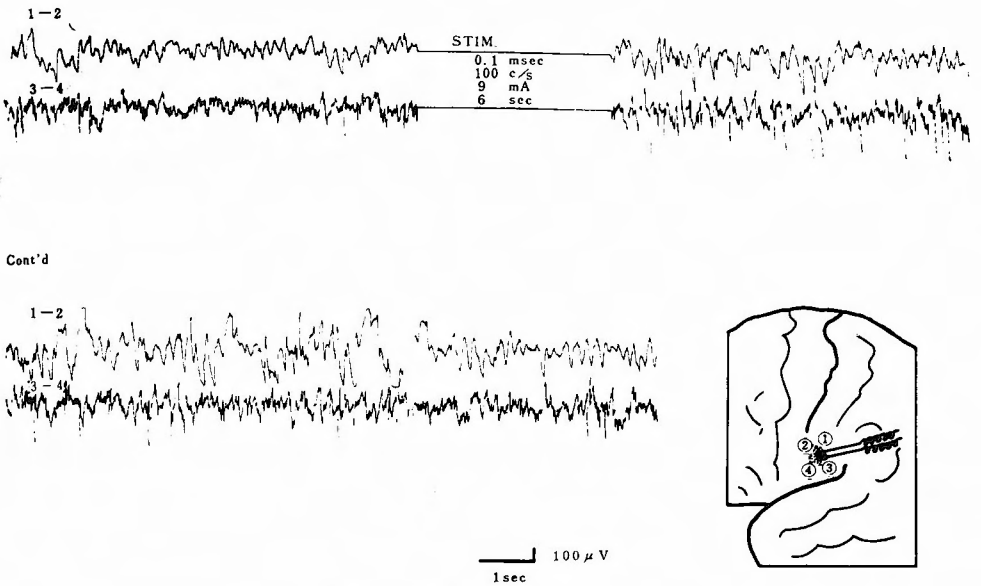


Fig. 4 Case T. A. Cortical stimulation

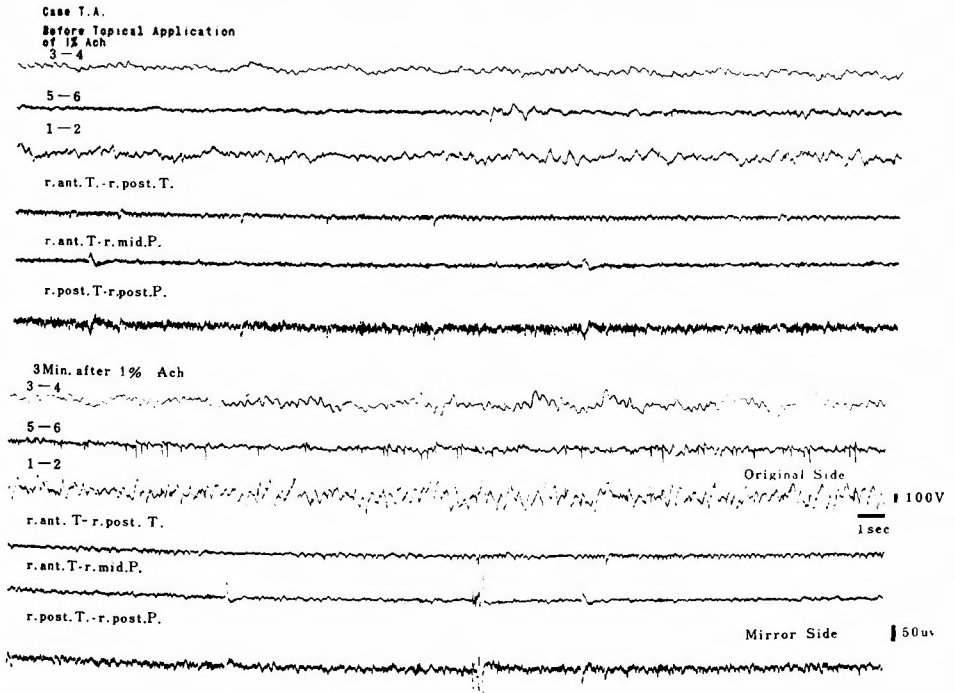


Fig. 5 Case T. A. Topical application of 1% Ach

awaked condition, transmission of the discharges to the homologous area contralateral to the original focus was obliterated and no definite discharge was observed from the mirror region at all (Fig. 5).

Operative excision of this epileptogenic focus was performed and histological specimen disclosed the glial proliferation. Subsequently, she had a smooth post-operative convalescence. Of course, we are aware that judgement of the results of surgical excision must be made after a lapse of sufficient length of time and it is too early to evaluate the merits of operation in this case. However, postoperative EEG taken about 3 weeks after, exhibited no evidence of persistence of seizure discharge both at the dominant and the projected (mirror) region and the patient has been free from the clinical attacks.

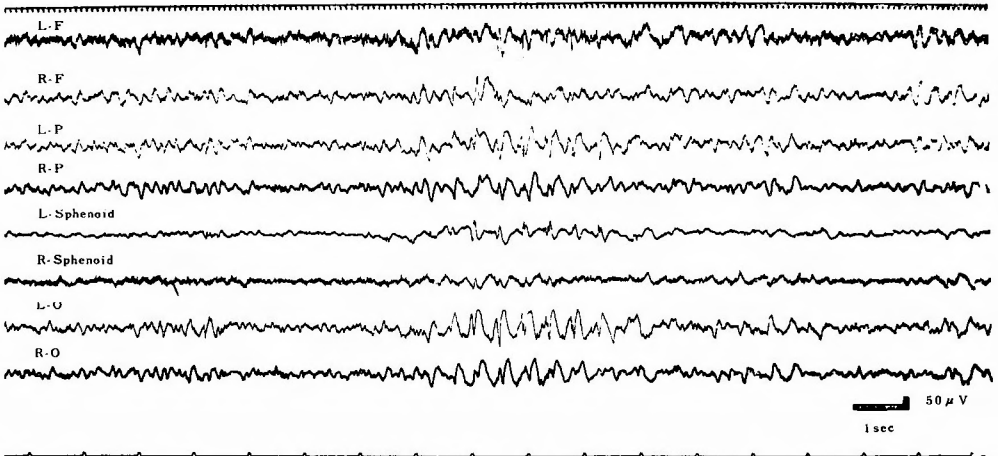


Fig. 6-A Case S. M. 18-year-old male before injection

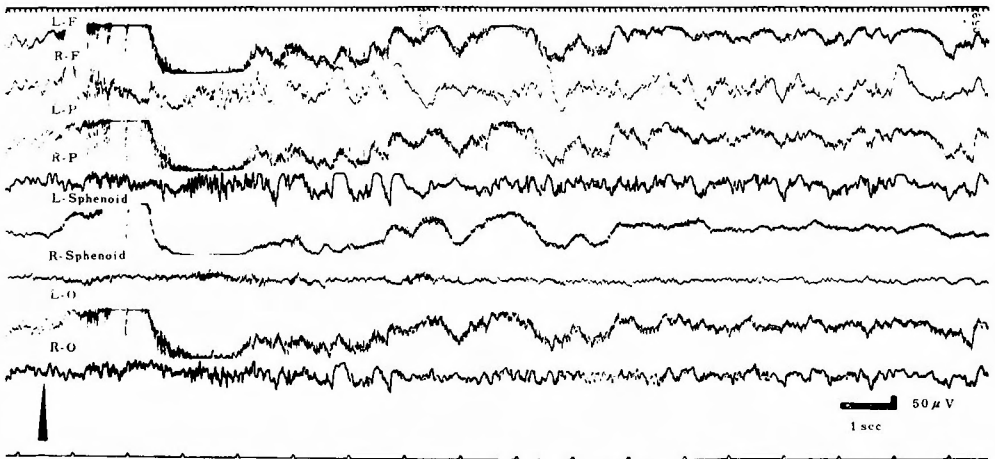


Fig. 6-B Case S. M. 18-year-old male 1-intracarotid injection of Sodium Amytal (200mg)

DISCUSSION

It is well known that transmitted disturbances from a cortical focus in one hemisphere to the homologous area of the opposite side produce mirror focus. However, only a few details are known regarding the underlying mechanisms of the so called "mirror focus" and it seems to be of value to report a case of the type we have described in this paper

indicating that such a small cortical pathology can also occasionally cause discrete bilateral electroencephalographical disturbances. Although similar cases have been reported by several authors (KENNEDY and HILL (1958)⁴⁾, FALCONER, et al. (1959)²⁾ (1961)³⁾), they are mainly concerned with the cases having discrete temporal lobe focus and we know of no previously published clinical report describing a case with bilateral EEG disturbances produced by such a small unilateral neocortical lesion which was confirmed at the operation.

Since the early description of BAILEY and GIBBS (1951)¹⁾, many authors have pointed out that the best operative result can be obtained in the cases in which the epileptic discharges are strictly confined to the unilateral cortex and conversely, the presence of a second discharging focus on the opposite side definitely has worse influence on the results. Yet the problem remains that certain cases with bilateral spiking can be benefited by unilateral operation. Especially, good results can be expected by a unilateral operative procedure in such a case as described in this paper, in which seizure discharges were strictly limited to the discrete area of one hemisphere and to the homologous area of the opposite side, without showing any overt evidence of wide-spread projected disturbances at elsewhere in both cortices and besides one-to-one relation could be observed between the spikes recorded on one side and the opposite one. These findings strongly indicate that the primary focal discharges of one side are conducted through the principal commissural pathways straight to the opposite side, not via subcortical relay system, and EEG disturbances recorded from the opposite side are simply in the form of projected waves from the dominant focus. In such cases having secondary focus which can not be regarded as evidence of independent changes in that side, the seizure may be relieved by a unilateral operation.

However, we have as yet no EEG criteria of deciding the dependence or independence of the so called "mirror focus" with high accuracy. In this respect, intracarotid injection of sodium amytal may be a useful tool with a high degree of predictive value and we feel that this method warrants a more extended trial.

Method of intracarotid injection of sodium amytal introduced by WADA (1946)⁷⁾ as a technique for studying cerebral dominance in man was applied by MORRELL (1960)⁵⁾ to experimentally produced epileptogenic focus and by Rovit, et al. (1961)⁸⁾, to certain patients with complicated seizure problems in EEG for the purpose of analyzing the function of secondary produced foci. Through these authors' works, the evidence has been accumulated that if the secondary (mirror) focus has not an autonomous potential, an injection of the drug into the carotid artery on the side of dominant focus, will give rise to almost complete and immediate suppression of epileptic discharge bilaterally. In contrast, in case of the secondary focus has a true independent potential, epileptic discharge from the secondary side might persist. Fig. 6 illustrates changes in pre- and postinjected EEGs of a different case we have encountered in which clinical examinations revealed the existence of cortical atrophy in left parietal region and his clinical attacks were a type of right sided Jacksonian seizures. As shown in Fig. 6-A, preinjected EEG disclosed bilateral atypical spike-and-wave in burst with left sided predominance and 200 mg of sodium amytal into the left carotid did not inhibit completely the right sided seizure discharges (Fig. 6-B) suggesting strongly that alleviation of the right sided EEG disturbances can not be expected by the simple unilateral (left sided) operative procedures.

SUMMARY

One case is presented in which such a small cortical gliosis as the range of within the limit of 1 square centimeter was confirmed at the left posterior parietal region, and her preoperative EEGs disclosed the discrete transmitted focus at the homologous area of the opposite side.

Bilateral EEG disturbances and her clinical seizure disappeared completely after excision of the dominant focus.

Intracarotid injection of sodium amytal, as the tool of analyzing the function of the secondary focus is also discussed.

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和文抄録

1 側皮質小病変により鏡焦点の形成がみられた 1 症例

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8才の女子，以前より睡眠時に癲癇発作あり，手術時，左側後頭頂部に僅か 1 cm^2 弱の限局性グリオーシスを認め，これを切除したが，術前記録脳波には毎常単に左側頭頂葉のみならず，反対側対称部である右側頭頂葉部からも著明な癲癇性放電が出現し，所謂鏡焦点の形成が認められた。患者の発作及びこの両側性脳波異常共に術後今日まで完全に消失している。

本症例の如き限局性極小病変による鏡焦点の形成に

ついては，側頭葉性癲癇における若干の報告がみられるにすぎない。又鏡焦点の機能については不明な点が多く，殊に原焦点とは機能的に独立した鏡焦点が人間においても存在するか否かの問題が解明されていない。この点，鏡焦点の独立性の有無を術前に確かめる手段として，sodium amytal の頸動脈よりする動注法につき，自験例を提示し検討を加えた。