

Reflex Epilepsy Induced by Playing Oriental Card or Board Games

Sang Ahm Lee, M.D., Eun Jung Choi, M.D., Joong Koo Kang, M.D.

Department of Neurology, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Background and Purpose: There are currently few studies on clinical profiles of reflex epilepsy induced by thinking and spatial tasks. We studied the clinical characteristics of reflex epilepsy induced by playing oriental card and board games.

Methods: This study included 17 patients who presented with seizures that occur predominantly while playing games. We collected clinical data via protocol-based interviews. EEGs and brain MRI were performed.

Results: All of the subjects were men, and all of them were older than 30 years at the onset of seizure. Thirteen patients (76%) experienced their seizures while playing the oriental card game "Go-stop" and the remaining four patients (24%) experienced them while playing the oriental board game "Baduk". Generalized tonic-clonic seizures were frequently preceded by prodromal symptoms, but myoclonus was not evident. Most patients had no spontaneous seizures and generalized epileptiform discharges on EEGs, and infrequent seizures that were well controlled.

Conclusions: Our patients exhibited some features that differ from those described previously in the literature, suggesting that the clinical spectrum of reflex epilepsy induced by thinking and spatial tasks is wide.

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Key Words : Reflex epilepsy, Thinking, Idiopathic generalized epilepsy

INTRODUCTION

Since the first report of reflex epilepsy by Ingvar and Nyman¹ in 1962, there have been several papers on reflex epilepsy induced by thinking and spatial tasks. The range of triggering stimuli is remarkably wide, including mental arithmetic,² drawing,³ writing,^{4,5} decision making,⁶ playing cards or chess,^{7,8} and thinking.⁹ However, since the clinical profile of this form of reflex epilepsy is relatively uniform, it has been considered as a rather homogeneous syndrome of idiopathic generalized epilepsy (IGE).^{10,11}

Kwan and Su recently reported the clinical features of 12 patients with Mah-jong-induced reflex epilepsy that were very different from those described previously.¹² Seizure onset in their Chinese patients was in adulthood, and they exhibited no generalized epileptiform discharges on EEGs.

There have been few studies on the clinical profile of reflex epilepsy induced by thinking and spatial tasks because of the rarity of this form of reflex epilepsy. Therefore, in the study presented here we investigated the clinical characteristics of reflex epilepsy induced by playing the oriental card game "Go-stop" and the oriental board game "Baduk". The clinical profile of our

Table 1. Summary of patient demographics and clinical seizure patterns

No	sex/age	age at onset	risk factors	family history	brain image	spontaneous seizure	stimuli	seizure latency after stimuli	reflex seizure patterns	number of GTCs	EEG	AED
1	M/56	55	No	No	multiple lacunes	No	gostop	6-10 h	A-GTC	2	WNL	No
2	M/44	31	No	No	left cuneus encephalomalacia	No	gostop poker	6-7 h	A-GTC	2-4 /year	WNL	VPA*
3	M/55	41	perinatal problem	No	WNL	No	gostop	5-6 h	A-GTC, A	6	abnormal	VPA
4	M/55	47	No	Yes	WNL	No	baduk	5-12 h	GTC	2	WNL	VPA
5	M/52	47	No	No	WNL	No	gostop	8-9 h	A-GTC	4	WNL	VPA*
6	M/51	48	No	No	WNL	No	gostop	10-20 h	A-GTC	2	WNL	No
7	M/49	46	No	No	WNL	No	gostop decision making poker	7-10 h	A-GTC	5	WNL	No
8	M/51	31	No	Yes	not done	No	baduk	2-5 h	A-GTC,A	3	WNL	No
9	M/48	32	near-drowning	No	WNL	No	gostop	8-12 h	A-GTC,A	7	WNL	No
10	M/71	40	No	No	right MCA infarction	No	baduk	5-10 h	A-GTC	3	WNL	PHT
11	M/50	38	No	Yes	WNL	No	gostop	5-6 h	GTC	3	WNL	VPA*
12	M/74	48	No	No	multiple lacunes	No	baduk poker	3-20 h	GTC	5	WNL	VPA*
13	M/24	18	No	No	WNL	Yes-M,A	gostop decision making calculation	3-4 h	GTC,A	3	WNL	VPA
14	M/73	66	No	No	WNL	No	gostop	2-5 h	GTC	10	abnormal	No
15	M/58	54	No	Yes	WNL	No	gostop	7-8h	GTC	5	WNL	VPA
16	M/47	34	No	No	WNL	No	gostop	6-7 h	GTC	3	WNL	No
17	M/49	44	No	No	WNL	No	gostop	7-8 h	A-GTC	5	abnormal	No

MCA; middle cerebral artery, WNL; within normal limit A; isolated absences, M; myoclonus, GTC; generalized tonic clonic seizure, A-GTC; generalized tonic clonic seizure preceded by absence, h; hour, VPA; valproic acid, PHT; phenytoin, AED; antiepileptic drug, *; irregular antiepileptic medication

patients was compared to those reported previously. Go-stop is one of the Japanese Flower Card games, and Baduk (also called “Go” in Japanese) is one of the most popular board games in East Asia, including Korea, Japan, and China.

MATERIALS AND METHODS

We encountered 17 patients who visited our neurological clinic between 1996 and 2003 with the chief complaint of seizures occurring while playing Go-stop or Baduk. Patients who had experienced only one episode of seizure were not included. We collected clinical information including their typical seizure patterns, family history, and past medical history via

protocol-based interview performed by one of the authors. Twenty-one-channel awake and sleeping EEGs were recorded with scalp electrodes in all patients. All except one patient underwent a brain MRI study.

RESULTS

1. Clinical features

The demographic data of the patients are summarized in Table 1. All of the patients were men, aged 24–74 years (mean, 53.3 years), with an age at seizure onset ranging from 18 to 66 years (mean, 42.3 years). The duration of epilepsy ranged from 1 to 32 years (mean, 13.6 years). All except one patient ($n=16$; 94%)

experienced seizure onset in adulthood (older than 30 years); the remaining patient had his first seizure in adolescence. Fifteen patients (88%) had no risk factors for seizures. One patient had a history of near drowning and one a history of perinatal problems.

Four patients had a family history of epileptic seizures. Patient 11 had a daughter who developed three episodes of seizures during her childhood and achieved seizure remission without any antiepileptic medication. Patient 8 had a daughter who was clinically diagnosed with juvenile myoclonic epilepsy, and whose first seizure occurred while taking an IQ test. Patient 4 had a brother with posttraumatic epilepsy, and patient 15 had a second-degree-relative with epilepsy.

The neurological examination was normal in all but one patient (patient 10), who had experienced a cerebral infarction in the right middle cerebral artery 15 years after his first seizure attack.

2. Specific reflex activation and clinical seizure patterns

Thirteen out of the 17 patients (76%) experienced their seizures while playing Go-stop, and the remaining 4 patients (24%) while playing Baduk. In 13 patients, their seizures were induced by only one type of game (i.e., either Go-stop or Baduk). However, the seizures in the remaining four patients were also induced by playing poker, decision making, or performing calculations.

Generalized tonic-clonic seizures (GTCs) were evident in all of the patients. In 14 patients (82%), GTCs were preceded by a period of prodromal symptoms, including visual illusions, mental cloudiness, fragmentation of thinking, febrile sensation, dizziness, nausea, or headache. Such prodromal symptoms lasted from several minutes to half an hour. Ten patients (59%) exhibited single or recurrent absence-like episodes during the period of prodrome. No patients registered myoclonic jerks when playing the games. One had infrequent spontaneous myoclonic seizures without the presence of an identifiable factor. All patients who had prodromal symptoms reported that they could prevent seizures if they stopped playing games.

The latency to occurrence of an actual seizure was

mostly 6-8 hours (ranging from 3 to 20 hours) after the patients started playing Go-stop, while those playing Baduk showed a time lapse of 3-5 hours (ranging from 2 to 20 hours) before an actual seizure attack. Fourteen patients (82%) reported that when they played the game with lack of sleep, they experienced seizures.

Spontaneous GTCs without reflex activation did not occur in all patients. Patient 13 had infrequent absence-like or myoclonic seizures without an identifiable factor.

3. EEG and brain images

EEG findings were normal in 14 patients (82%). Abnormal EEG findings were intermittent generalized rhythmic delta activities (patient 3), intermittent spikes and waves from the left centroparietal area (patient 14), or intermittent slowing in left hemisphere (patient 17).

Brain MRI findings were normal in 13 patients (76%). One patient (patient 2) had an encephalopathic lesion in the left cuneus. The other findings were multiple lacunar infarction in two patients and cerebral infarction of the right middle cerebral artery territory in one.

4. Medications and prognosis

Eight patients had never received antiepileptic drugs. Five patients were treated with monotherapy on a regular basis (four with valproate and one with phenytoin). Four patients were administered with valproate irregularly. Thirteen patients had been seizure free for at least the past 3 years, and this was not affected by the taking of antiepileptic medication. Fifteen patients (88%) had infrequent seizures (less than eight in total).

DISCUSSION

Stimuli that evoke seizures in our patients, such as playing Go-stop or Baduk, have not yet been described in the English literature. Go-stop is one of the most popular card games in Korea, and is analogous to poker

Table 2. Comparison of clinical characteristics between our data and the previous literatures

	Our patients (N=17)	Andermann et al. ^{10,11} (N=25)	Kwan and Soo ¹² (N=12)
Sex ratio (male%)	100%	76%	100%
Mean age at onset (year)	42.3	15.4	48.7
Clinical type of seizures (%)			
GTCs	100%	96%	100%
Absence	64.7%	60%	-
Myoclonus	0%	76%	-
EEG findings			
Normal	82.3%	80%	50%
GSWC	0%	68%	0%
Spontaneous seizure	5.8%	76%	33%
Latency to occurrence of seizures	2-20 hours	not available	1-11 hours
Prognosis	good	good	good

GTCs; generalized tonic clonic seizure, GSWC; generalized spike and wave complexes, N; number of patient

in Western culture. During the game, if one player has more than 3 points, he can stop the game. If he has a chance of winning the game, despite having more than 3 points, he would rather call “go” than “stop” the game. Baduk is also one of the most popular games in East Asia, including Korea, Japan, and China. It is played on a 19x19-square checkerboard, battling over territories with white and black stones. In-depth thinking and decision making are very important in these games. The reflex activation evoked by these games require a fairly long period of triggering activity before clinical seizures occur. Stress and sleep deprivation have an additional activating effect. These features have also been reported in the previous literature.¹⁰⁻¹² The exact mechanism underlying reflex epilepsy induced by thinking and spatial tasks is not clear, but it has been suggested that it involves parietal cortical activation with rapid secondary generalization.^{9,11}

Andermann and colleagues^{10,11} discussed the clinical profile of reflex epilepsy induced by thinking and spatial tasks. Its key features were a preponderance of males, seizure onset around puberty, GTCs frequently associated with absence and/or myoclonus, a high proportion of patients with spontaneous seizures, and generalized spike or polyspike and wave complexes in EEGs. They suggested that this form of reflex epilepsy might be a rather homogeneous syndrome with the

clinical and EEG characteristics of IGE.⁹⁻¹¹ This suggestion has been supported by Inoue et al.¹³ and Yamamoto et al.¹⁴

The clinical features of our patients are different from those of Andermann and colleagues.^{10,11} First of all, in most of our patients seizure onset occurred in adulthood rather than in adolescence. The mean age at seizure onset in our patients was 42.3 years, which is much older than that of the Andermann cohort (mean, 15.4 years). Moreover, our patients did not usually experience spontaneous seizures, generalized epileptiform discharges in EEGs, or myoclonus just before clinical seizures. These clinical and EEG differences from the Andermann cohort have also been described previously by Kwan and Su,¹² who reported on 12 Chinese epilepsy patients whose seizures were induced by playing Mah-jong. Their clinical characteristics were very similar to those of our patients (Table 2). These differences may not be attributable to differences in the ethnicity between the Asian and Western patients studied, since the clinical features of patients observed in the Japanese literature^{13,14} are quite similar to those observed by the Andermann group. Although the triggering stimuli have differed somewhat between studies, it is also unlikely that this factor is responsible for the differences in the clinical profiles between groups. However, it is possible that the difference in age at seizure onset has important

implications. Recently, the clinical characteristics of IGE in patients aged over 40 years were assessed;¹⁵ only 4.5% of patients had myoclonic seizures. In two series of 90 and 80 adult-onset patients (≥ 19 years old) diagnosed as having IGE, generalized spike and wave discharges were present in only 36 and 48 patients, respectively.¹⁶ These data may explain why there was a paucity of myoclonus and EEG abnormalities our patients with late-onset seizures. It is not clear whether the late seizure onset in our patients reflects a phenotypic difference in the clinical spectrum or a late exposure to specific triggering stimuli. In Korea, younger people are less likely to play Go-stop or Baduk, especially for a prolonged period.

Little is known about the prodromes and their prevalence. However, it is not uncommon for patients or parents of children with epilepsy to report the occurrence of prodromal symptoms.^{17,18} Of our patients, 82% reported prodromal symptoms, including visual illusions, mental cloudiness, fragmentation of thinking, febrile sensation, dizziness, nausea, or headache. Such prodromal symptoms lasted several minutes to half an hour. The exact mechanisms that underlie prodromal symptoms remain unknown. Furthermore, ten of our patients exhibited single or recurrent absence-like episodes during a prodromal period. These episodes may include motionless staring during in complex partial seizures. Furthermore, generalized interictal or ictal discharges were not evident in our patients. Therefore, we cannot completely eliminate the possibility of partial seizures in our cases.

Reflex epilepsy induced by playing Go-stop or Baduk has a benign nature. Most of our patients had infrequent seizures and were seizure free for several years regardless of whether they received antiepileptic medication. Avoiding playing these games was the most effective way to prevent seizures. Most patients had prodromal symptoms before the actual convulsive seizures occurred, so they could prevent a seizure if they stopped playing games.

In summary, patients with reflex epilepsy evoked by playing Go-stop and Baduk have the following general clinical characteristics: male preponderance, adult-onset seizures, rare spontaneous seizures, no symptomatic

causes, and a benign prognosis. Some of these features of our patients differ from those reported previously in the literature, suggesting that the clinical spectrum of reflex epilepsy induced by thinking and spatial tasks is wide.

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