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Can an exercise bicycle be safely used in the epilepsy monitoring unit?: An exercise method to provoke epileptic seizures and the related safety issues

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ABSTRACT

Background and purpose: Long-term videoelectroencephalogram (video-EEG) monitoring is performed to diagnose an epileptic seizure and to investigate the differential diagnosis of paroxysmal events. To provoke an epileptic seizure, an exercise method is performed in some cases during long-term video-EEG recording in the epilepsy monitoring unit (EMU). The purpose of this study was two-fold: to assess the frequency and severity of adverse events associated with the use of an exercise bicycle and to find a way to safely use it in the EMU.
Methods: A retrospective survey was performed on all epileptic seizure videos recorded in the EMU from January 2012 to December 2013. Three hundred and fifty patients were included in this study.
Results: Eleven patients experienced an epileptic seizure while riding the exercise bicycle in the EMU. One patient's foot got stuck between the cycling pedal and its strap, and one patient fell off the exercise bicycle during the epileptic seizure. However, there were no serious adverse events over two years.
Conclusion: Epileptic seizures were not frequent while riding the exercise bicycle, and serious injuries did not occur. But, there is a need to improve the safety in the EMU to control the potentially dangerous factors associated with the use of the exercise bicycle and to continuously monitor the patients with help from the staff.

1. Introduction

Long-term videoelectroencephalogram (video-EEG) is one of the most important diagnostic methods for epilepsy. Time locking of the EEG and video monitoring allows the correlation of paroxysmal events with electrical brain activities. This procedure is usually performed in the epilepsy monitoring unit (EMU) when epileptologists diagnose the paroxysmal behavior, epileptic seizures, and sleep disorders and localize the seizure foci for epilepsy surgery [1–4]. Epileptologists use some methods to precipitate epileptic seizures and to reduce the duration of monitoring; the most common methods are tapering the antiepileptic drug(s), sleep deprivation, and hyperventilation. Occasionally, the exercise method is also used, if it is either feasible or appropriate to provide a seizure [5-8].

During the stay in the EMU, patients may experience various degrees of harmful events and injuries related to seizures, such as status epilepticus, postictal psychosis, aspiration pneumonia, cardiac arrest, fracture, and death [9–13]. Safety issues are very important for patients and staff in the EMU. However, the safety of the exercise method has rarely been evaluated. In our EMU, we have recommended the exercise method for the past two years for all the assessed patients except for the patients undergoing invasive monitoring. We retrospectively reviewed the epileptic seizures that occurred while patients in the EMU were riding the exercise bicycle. The aim of

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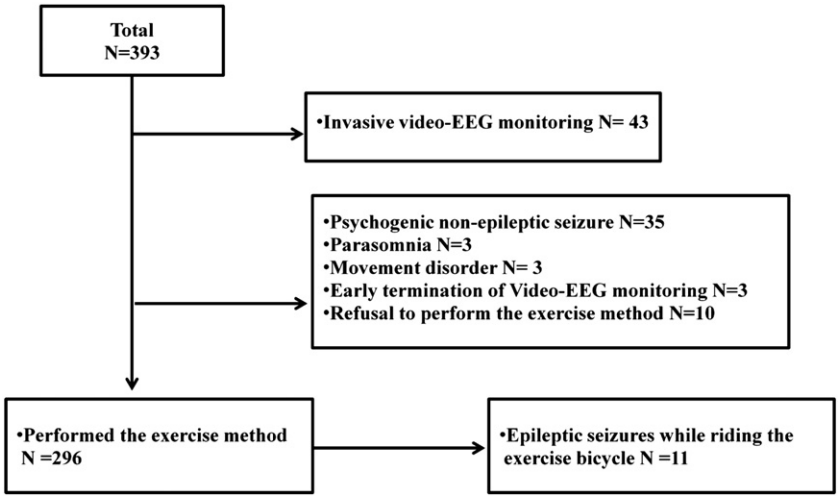

Fig. 1. A chart demonstrating the number of patients who were evaluated in the EMU and developed an epileptic seizure while riding the exercise bicycle.

Table 1
Demographics and clinical features.

Patient number	Gender	Age	Age at onset of epilepsy	Total number of AEDs	Etiology	Epilepsy syndrome
1	F	50	25	5	Cryptogenic	TLE, NL
2	M	38	28	3	DNET	TLE, Rt
3	M	35	17	3	Posttraumatic	FLE, Rt
4	M	20	8	1	Cryptogenic	FLE, NL
5	F	27	6	5	HS	TLE, Lt
6	M	54	20	5	HS	TLE, Lt
7	M	48	37	3	Postinfectious	Unclear (SZ not lateralized and localized)
8	F	18	11	2	HS	TLE, Lt
9	F	44	31	3	Cryptogenic	TLE, Lt
10	M	21	19	2	Cryptogenic	Generalized
11	F	37	29	1	Vascular malformation	TLE, Lt

AED: antiepileptic drug, F: female, M: male, HS: hippocampal sclerosis, DNET: dysembryoplastic neuroepithelial tumor, TLE: temporal lobe epilepsy, FLE: frontal lobe epilepsy, NL: nonlateralized, Rt: right, Lt: left, and SZ: seizure.

this study was two-fold: to evaluate the frequency and severity of adverse events that occurred while performing the exercise method in the EMU and to find a way to safely perform the exercise method such as riding the exercise bicycle in the EMU.

2. Methods

2.1. Patients and clinical data

In this study, we retrospectively reviewed video-EEG data of all the patients who were hospitalized in the EMU at the Department of Neurology, Samsung Medical Center, Korea from January 2012 to December 2013. Three hundred and ninety-three consecutive patients underwent video-EEG monitoring in the EMU. Forty-three patients underwent invasive video-EEG monitoring using subdural and/or depth electrodes. They were not asked to ride the exercise bicycle during EEG monitoring, and hence, they were excluded from this study. On admission, three hundred and fifty patients who had undergone noninvasive monitoring were recommended the exercise method from the second day of monitoring irrespective of whether they took an antiepileptic drug or not. The patients were asked to ride the exercise bicycle for at least 1 h a day. We used a reclining exercise bicycle. We reviewed all of their medical records and the recorded epileptic seizure videos and identified the epileptic seizures that occurred while the patients were riding the exercise bicycle. The 'only aura' event was also considered as an epileptic seizure. Additionally, the patients' medical records were carefully reviewed to confirm the clinical information and to assess the severity of adverse events in the EMU.

Table 2
Patients who developed epileptic seizures during the exercise method (bicycle).

Patient number	Total number of seizures recorded	Duration of monitoring in days	Day of onset of the seizure while riding the exercise bicycle	Number of seizures while riding the exercise bicycle	Semiology of the seizure while riding the exercise bicycle	Reason for video-EEG monitoring	Adverse events while riding the exercise bicycle
1	19	6	2	1	CPS	Refractory seizure	No adverse event
2	6	8	4	1	CPS	Refractory seizure	No adverse event
3	2	16	16	2	CPS progressing to GTC seizure	Refractory seizure	Foot got stuck, not serious, ictal SPECT was not performed
4	39	5	3	1	CPS	Unclear epilepsy syndrome	No adverse event
5	23 (only aura: 10)	9	2	1	CPS	Refractory seizure	No adverse event
6	12 (only aura: 8)	19	5	2 (only aura)	Psychic aura	Refractory seizure	No adverse event
7	5	11	3	1	CPS	Refractory seizure	No adverse event
8	4	9	8	4	CPS	Refractory seizure	No adverse event
9	6	12	10	4	CPS	Refractory seizure	No adverse event
10	1	3	2	1	Myoclonic SZ progressing to GTC SZ	Unclear epilepsy syndrome	Fell off the bicycle, not serious
11	4	12	4	1	CPS	Refractory seizure	No adverse event