Seizure (2006) **15**, 576—581

ELSEVIER

SEIZURE

www.elsevier.com/locate/yseiz

Effect of interseizure interval on seizure lateralization in patients with bilateral seizure foci

Eun Jung Choi, Joong Koo Kang, Sang Ahm Lee *

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

Received 7 April 2006; received in revised form 4 July 2006; accepted 10 August 2006

KEYWORDS
Cluster effect;
Interseizure interval;
Bilateral seizure foci;
Video-EEG monitoring

Summary We investigated whether there is a cluster effect depending on localization of seizure foci in patients with bilateral seizure foci. We evaluated 171 seizure pairs from 193 seizures recorded in 28 patients. Seizure lateralization was determined by the lateralization of ictal discharges; if the ictal EEG pattern was not lateralized, lateralization was determined by clinical seizure semiology. The logarithm of the interseizure interval (ISI) was significantly related to seizure concordance only in patients with extratemporal seizure foci, but not in those with bitemporal foci. In the former group, the mean ISI for concordant seizure pairs was significantly shorter than that for discordant seizures pairs (292 min versus 631 min, $p = 0.023$). Seizure types composing seizure pairs had a significant influence on ISI regardless of the localization of seizure foci. ISIs were shortest in seizure pairs with only partial seizures. However, types of seizure pairs were significantly related to concordance rates of seizure lateralization only in patients with extratemporal foci ($p = 0.005$). In conclusion, our results suggest that the cluster effect on seizure localization exists in patients with extratemporal seizure foci, but not in those with bitemporal foci.

Introduction

In patients with medically intractable epilepsy, long-term video-EEG monitoring has been used to record seizures and to localize their origin.[1] Long-term monitoring can select good candidates for epilepsy surgery, as well as exclude poor candidates, such as patients with bilateral independent seizure foci. To determine whether multiple seizure foci are present, several seizures should be recorded. In addition to recording a sufficient number of seizures, the effect of interseizure interval (ISI) on seizure localization should be determined. Seizures occurring after shorter ISIs have been reported to be more likely to arise from the same origin than are seizures with longer ISIs.[2,3] This cluster effect was

* Corresponding author. Tel.: +82 2 3010 3445; fax: +82 2 474 4691.
E-mail address: salee@amc.seoul.kr (S.A. Lee).

1059-1311/$ — see front matter
doi:10.1016/j.seizure.2006.08.001

not observed, however, in a recent prospective study.[4] Reliably interpreting seizures with variable ISIs has important clinical implications regarding the localization of seizure origins.

Inconsistent results in past studies regarding the existence of a cluster effect may be due to differences in the types of patients recruited or to heterogeneous patient populations within a particular study. Frontal lobe seizures have been characterized as occurring many times a day and in 'flurries' with only brief ISIs, unlike seizures arising from the temporal lobe.[5–8] Recently, a significant association between extratemporal epilepsy and seizure clustering has been reported.[9] Since it is likely that differences in patterns of seizure recurrence depend on the foci from which the seizures originate, we hypothesized that the effect of ISI on seizure localization may be influenced by the location of seizure foci. We therefore categorized patients by their localization of seizure foci into bilateral temporal and bilateral extratemporal seizure groups. We then determined whether a cluster effect was present in each group of patients with bilateral seizure foci.

Methods

Patient selection

We reviewed the epilepsy registry of 640 consecutive patients with medically intractable epilepsy who underwent scalp video-EEG monitoring for presurgical evaluation from January 1996 to December 2004 at Asan Medical Center. Based on the results of scalp video-EEG monitoring, we found 31 patients who had 3 or more recorded seizures, with seizures arising independently from the right and left hemispheres. Three patients were excluded because their EEG digital files were not open. Thus 28 patients were included in this study; the video-EEG data of these patients were investigated.

Patients were categorized into those with bilateral temporal seizures and those with bilateral extratemporal seizures based on the results of scalp ictal EEGs. Patients were categorized as having bilateral temporal seizures if at least one ictal discharge each could be clearly localized independently to the right and left temporal areas and were not regionally localized to any extratemporal area. Patients were categorized as having bilateral extratemporal seizures if they had bilateral independent seizure foci but could not fit the criteria for the bilateral temporal group.

Seizure analysis

Scalp ictal EEGs were recorded using the international 10—20 system plus bilateral sphenoidal and inferior temporal electrodes. Anticonvulsants were reduced or discontinued during video-EEG monitoring in most patients. Ictal EEGs were analyzed using a digital EEG system that allowed for reformatting the data in any desired montage. To assess seizure localization, all seizures were reviewed both clinically and electrographically by two independent investigators (Choi and Lee), and any disagreement was resolved by consensus. We excluded seizures occurring before the clinical or electrographical features had returned to baseline after the previous seizure.

Ictal EEGs were assessed on the basis of previously published criteria.[10] Briefly, EEG seizure onset was defined as the first unequivocal ictal EEG pattern lasting at least 3 s. Lateralization of ictal discharges was initially determined by unilateral ictal onset pattern. A later significant pattern was used for ictal discharge lateralization only when there was no ictal onset pattern. The later significant pattern was defined as the dominant ictal EEG pattern after the first 10 s of seizure onset. Ictal onset or later significant patterns were used for lateralization only if they lasted $>$10 s.

The localization of ictal patterns was classified as regionalized, lateralized, or non-lateralized. A regionalized temporal ictal EEG was defined when the amplitude in one temporal chain was at least two times higher than the amplitude in the ipsilateral parasagittal bipolar montages. A lateralized ictal EEG was defined when the amplitude in the referential montages of one hemisphere was at least twice the amplitude in the contralateral hemisphere.

Seizure lateralization was determined by the lateralization of ictal discharges; if the ictal EEG pattern was not lateralized, seizure lateralization was determined by the clinical seizure semiology. We used clinical lateralizing signs found to have a greater than 90% lateralizing accuracy.[11–14] These included unilateral dystonic/tonic posturing, head version just before secondary generalization or the end of seizure, unilateral clonic movements, mouth deviation, and ictal speech. Seizures were classified as clinically lateralized if at least one of these lateralizing signs could be identified. Seizures were regarded as not lateralized if these ictal features pointed to different sides or if none occurred.[11,12]

Each pair of consecutive seizures was classified as 'concordant' (both seizures originating in the same hemisphere), 'discordant' (seizures originating in opposite hemispheres), or 'indeterminate' (one or