

## EMERGENCY EEG AND DIAGNOSTIC YIELD

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**SUMMARY** – The aim of the study was to determine whether an acute loss of consciousness, mental status change or related symptoms correlated with the presence of epileptiform abnormalities on urgent EEG. We analyzed 228 consecutive patients admitted to Emergency Room during the past 12 months and referred for urgent EEG evaluation. All patients had either a brief loss of consciousness or acute brain disorder, with a clinical diagnosis of epilepsy, syncope, head trauma, headache, transient ischemic attack (TIA) or vertigo. Statistical analysis was performed using Spearman's rho test for group comparison and multivariate regression analysis. The mean age of patients was  $48 \pm 20$  years. The frequency of referring clinical diagnoses was as follows: epilepsy 44.7% (102/228), TIA 15.8% (36/228), syncope 15.4% (35/228), headache 11% (25/228), vertigo 7.9% (18/228) and acute head trauma 5.3% (12/228). EEG indicated epileptiform abnormalities in 14.9% (34/228) and focal slowing in 9.2% (21/228) of patients. The majority of them (26%; 21/81) had a clinical diagnosis of epilepsy. There was a significant correlation between clinical diagnosis of epilepsy and epileptiform EEG (Spearman's  $\rho=0.13$ ;  $P<0.04$ ). Multivariate regression analysis showed that there was no predictive value in the clinical diagnosis of epilepsy and epileptiform EEG ( $\beta=1.483$ ,  $P=0.16$ ). In conclusion, epilepsy was the most common clinical diagnosis in patients referred for urgent EEG. There was a significant correlation between the diagnosis and specific EEG abnormalities, however, the diagnosis of epilepsy failed to predict epileptiform activity on EEG. Study results suggested urgent EEG to have a high yield in patients with epilepsy.

**Key words:** *Seizures – diagnosis; Seizures – etiology; Electroencephalography; Status epilepticus – diagnosis*

### Introduction

Diagnostic evaluation of patients with transient loss of consciousness, change in mental status or abnormal motor activity often presents a challenge for the physician<sup>1-3</sup>. Differential diagnosis is complex and needs to be performed without delay. Electroencephalography (EEG) has a great value in diagnosing cerebral dysfunction, from seizure activity to EEG changes in infectious, encephalopathic and neuro-

degenerative disorders<sup>1,4,5</sup>. EEG can be performed in emergency situations, as it is noninvasive and technically simple for use.

The aim of the present study was to test the hypothesis that the emergency room (ER) clinician can with high specificity diagnose seizure as being epileptic on the basis of the patient's clinical history. This means that EEG findings will be concordant with clinical diagnosis established at ER and predict 'positive' EEG findings, i.e. EEG epileptic abnormality in this group. We evaluated patients admitted to ER with transient loss of consciousness, change in mental status or acute cerebral symptoms, such as epilepsy, syncope, head trauma, headache, transient ischemic attack (TIA) and vertigo.

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Clinical diagnosis	$\beta$	P<
Epilepsy	1.483	0.16
TIA	0.435	0.71
Trauma	0.435	0.76
Headache	1.175	0.31
Syncope	0.786	0.48
Vertigo	0	

Fig. 1. Regression analysis of clinical diagnosis and EEG abnormalities.

### Patients and Methods

In this study, we analyzed 228 consecutive patients admitted to ER during a 12-month period, whose attending neurologist requested EEG. Patients were divided into groups according to their initial clinical diagnosis. The common findings recorded in all study patients were transient loss of consciousness or acute cerebral symptom such as headache, TIA, vertigo or head trauma.

The patients' clinical data were stored in the Neuronet digital database at our Department of Neurology. Statistical analysis was done using non-parametric method because of the sample distribution. We used Spearman's rho for group comparison and multivariate regression analysis.

### Results

The mean age of patients was  $48 \pm 20$  years. The initial clinical diagnoses were as follows: 44.7% (102 of

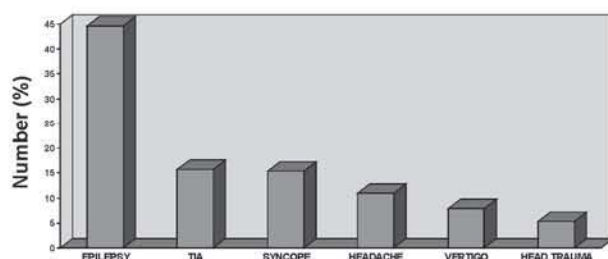


Fig. 2. Incidence of clinical diagnoses indicating urgent EEG.

228) epilepsy, 15.8% (36/228) TIA, 15.4% (35/228) syncope, 11% (25/228) headache, 7.9% (18/228) vertigo, and 5.3% (12/228) acute head trauma. Epileptiform discharges were recorded on EEG in 14.9% (34/228) and focal slowing in 9.2% (21/228) of them. The majority of patients with EEG abnormalities had the initial diagnosis of epilepsy (26%; 21/81). There was a significant correlation between the initial clinical diagnosis of epileptic event and EEG epileptiform abnormality (Spearman  $\rho=0.13$ ;  $P<0.04$ ). However, multivariate regression analysis for multiple clinical variables and EEG abnormalities was not significant ( $\beta=1.483$ ;  $P=0.16$ ).

### Discussion

We retrospectively analyzed consecutive patients admitted to ER during a 12-month period, whose clinical diagnosis suggested transient loss of consciousness, mental status change or acute cerebral symptoms. Epileptic seizure was the most common referral diagnosis in patients submitted to urgent EEG.

As the most important question, urgent EEG attempts to identify whether the patient's altered mental status is due to an epileptic event<sup>1</sup>. The aim of the study was also to find helpful predictive variables when ordering this examination. There are no large studies evaluating the utilization of EEG. Earlier studies found almost a 25% likelihood for some EEG abnormalities to be observed if the patient had sustained a stroke<sup>4-7</sup>. If the patient had arrest or recently witnessed seizures, EEG abnormalities are more than two times as likely to be recorded<sup>2,7-9</sup>.

We found a significant correlation between the initial diagnosis of epileptic event and specific EEG abnormalities. Multivariate regression analysis did not indicate the initial clinical diagnosis to predict epileptiform EEG abnormality.

In conclusion, our results showed EEG as part of the ER diagnostics to be highly specific in patients with transient loss of consciousness or mental status change.

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### Sažetak

## HITNI EEG I DIJAGNOSTIČKI DOPRINOS

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Željeli smo utvrditi korelira li akutni gubitak svijesti, promjena psihološkog statusa ili s tim poveznici simptomi s prisutnošću epileptiformnih nenormalnosti na hitnom EEG. Analizirali smo 228 susljednih bolesnika primljenih u Hitnu službu tijekom posljednjih 12 mjeseci, koji su upućeni na procjenu pomoću hitnog EEG. Svi bolesnici su imali kratak gubitak svijesti ili akutni moždani poremećaj uz kliničku dijagnozu epilepsije, sinkope, traume glave, glavobolje, prolaznog ishemijskog napada (TIA) ili vrtoglavice. U statističkoj analizi rabio se Spearmanov rho test za usporedbu skupina i multivarijatna regresijska analiza. Srednja dob bolesnika bila je  $48 \pm 20$  godina. Učestalost uputnih dijagnoza bila je kako slijedi: 44,7% (102/228) epilepsija; 15,8% (36/228) TIA; 15,4% (35/228) sinkopa; 11% (25/228) glavobolja; 7,9% (18/228) vrtoglavica i 5,3% (12/228) akutna trauma glave. EEG je otkrio epileptiformne nenormalnosti u 14,9% (34/228) i žairšnu usporenost u 9,2% (21/228) bolesnika. Većina bolesnika (26%; 21/81) je imala kliničku dijagnozu epilepsije. Utvrđena je značajna korelacija između kliničke dijagnoze epilepsije i epileptiformnog EEG (Spearmanov rho 0,13;  $P=0,04$ ). Multivarijatna regresijska analiza pokazala je kako klinička dijagnoza epilepsije i epileptiformni EEG nemaju nikakve prediktivne vrijednosti ( $\psi=1,483$ ;  $P=0,16$ ). Zaključili smo kako je epilepsija najčešća klinička dijagnoza u bolesnika upućenih na hitni EEG. Zabilježena je značajna korelacija između dijagnoze i specifičnih nenormalnosti na EEG, međutim, dijagnoza epilepsije nije predviđjala epileptiformnu aktivnost na EEG. Naši podaci ukazuju na to da hitni EEG ima visok rezultat u bolesnika s epilepsijom.

Ključne riječi: *Epileptični napadaji – dijagnostika; Epileptični napadaji – etiologija; Elektroencefalografija; Status epilepticus – dijagnostika*