Original Article

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Incidental Detection of Cardiac Arrhythmias during Routine Electroencephalography: Prevalence and Clinical Significance of Single-lead ECG Monitoring

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Abstract

Aim: Routine electroencephalography (EEG) recordings often include a single-lead electrocardiogram (ECG) channel, primarily to identify cardiac artifacts. However, incidental detection of cardiac arrhythmias during EEG may provide clinically relevant information. This study aimed to assess the prevalence and clinical relevance of arrhythmias detected during routine EEG.

Methods: This retrospective, descriptive, observational study included outpatient EEG recordings that were performed between April 2023 and December 2024. Routine and sleep EEGs recorded with simultaneous single-lead ECGs were analyzed. Reports were screened using arrhythmia-related keywords. Clinical, electrophysiological, and follow-up data were reviewed, and patients were compared by age group (<50 and ≥50 years).

Results: Arrhythmia-related findings were identified in 157 EEG reports (3.6%). Extrasystoles were the most frequent arrhythmia (35%), followed by atrial fibrillation (AF) (21%). Atrial fibrillation was observed exclusively in patients aged ≥50 years and showed a significant positive correlation with age ($r=0.413$, $p<0.001$). In six patients (3.8%), arrhythmias detected on EEG led to referral to cardiology and subsequent diagnosis of clinically significant cardiac conditions.

Conclusion: Single-lead ECG monitoring during routine EEG can reveal clinically important arrhythmias, including previously undiagnosed AF. Careful interpretation of ECG traces recorded during EEG may facilitate timely cardiology referral and improve patient management.

Keywords: EEG, ECG, arrhythmia, extrasystoles, atrial fibrillation, epilepsy

Introduction

Routine electroencephalography (EEG) recordings commonly include a simultaneously recorded, single-lead electrocardiography (ECG) channel. Current guidelines from the International Federation of Clinical Neurophysiology (IFCN) and the International League Against Epilepsy (ILAE) recommend routine ECG recording as the minimum recording standard for routine and sleep EEG recordings to facilitate accurate interpretation and patient safety (1). Although the ECG channel is primarily used to identify cardiac or pulse-related artifacts that may interfere with EEG interpretation, it also provides an opportunity for continuous cardiac rhythm monitoring during EEG recording. This additional information may be particularly valuable in patients evaluated for epilepsy or paroxysmal events, in whom cardiogenic conditions, such as syncope, may mimic epileptic seizures.

Misdiagnosis between epilepsy and cardiogenic syncope remains a significant clinical problem, with previous studies reporting that 20-30% of patients initially diagnosed with epilepsy ultimately have an underlying cardiovascular cause (2,3). The REVISE (Reveal in the Investigation of Syncope and Epilepsy) study reported that implantable loop recorders can detect cardiac arrhythmias

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in patients misdiagnosed with epilepsy, thereby helping to avoid unnecessary antiseizure medications (ASMs) (4).

On the other hand, cardiac arrhythmias are relatively common in patients with epilepsy (PWE), occurring during both ictal and interictal periods (5,6). While the detection of arrhythmias during seizures may be limited by movement and muscle artifacts, interictal EEG recordings provide a more stable setting for identifying arrhythmias. Importantly, ictal or peri-ictal arrhythmias, particularly asystole or bradycardia, can be life-threatening and may require cardiological intervention in addition to ASMs (7,8). These arrhythmias may reflect complex brain-heart interactions related to autonomic dysfunction and have been associated with increased morbidity, including sudden unexpected death in epilepsy (5,9). In addition, several ASMs, particularly sodium channel blockers such as carbamazepine, lamotrigine, lacosamide, and phenytoin, have been associated with proarrhythmic effects, further emphasizing the importance of cardiac rhythm assessment in this population (5,6,10,11).

We hypothesized that incidental arrhythmias detected during outpatient EEG recordings, particularly in patients without a previously known cardiac diagnosis, may have clinical relevance and contribute to improved diagnostic accuracy and patient management. Therefore, this study aims to determine the frequency and types of arrhythmias incidentally detected during outpatient EEG recordings and to evaluate their clinical importance, diagnostic value, and contribution to patient management. This approach may facilitate earlier cardiology referral and improve clinical decision-making in patients evaluated for epilepsy or paroxysmal events.

Materials and Methods

Compliance with Ethical Standards

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Ethical approval was obtained from the Scientific Research Ethics Committee No. 2 of the Basaksehir Cam and Sakura City Hospital (approval no: 2025-56, date: 26.02.2025). Due to its retrospective design, the ethics committee waived the requirement for informed consent. All patient data were anonymized prior to analysis.

Study Design

This retrospective, descriptive, observational study was conducted between April 2023 and December 2024 at the outpatient adult EEG Laboratory of Basaksehir Cam and Sakura City Hospital. Routine EEG recordings with a minimum duration of 20 minutes and sleep-induced EEG recordings lasting 90 minutes, all evaluated by a clinical neurophysiologist (F.A.I.), were included. Portable EEG recordings and EEGs with excessive artifacts were excluded.

Electroencephalography were recorded using a 21-channel EEG system (Neurowerk, Sigma Medizin-Technik GmbH, Germany) with electrodes placed according to the international 10-20 system. A single-lead ECG recording (using two electrodes) was obtained simultaneously with the EEG. The recording parameters were set to a paper speed of 25 mm/s, a voltage sensitivity of 1 mV/cm, and a frequency range of 0.5-70 Hz.

To identify relevant cases, a keyword-based search was conducted of EEG reports using terms associated with arrhythmias, such as "arrhythmia," "extrasystole (ES)," "bradycardia," "tachycardia," "atrial fibrillation (AF)," "atrioventricular (AV) block," "R-R irregularity," and "QT prolongation." Electroencephalography type (routine or sleep), detected arrhythmia type, and EEG findings (normal or abnormal) were documented. Demographic and clinical data, including age, gender, indication for EEG referral, clinical diagnosis, history of epilepsy, cardiac and other comorbidities, and medications such as ASMs, antiarrhythmic agents, and other cardiac drugs, were obtained from medical records. Follow-up data, including neurology and cardiology visits, additional cardiac evaluations such as routine ECG, Holter monitoring, echocardiography, and other advanced cardiac tests, as well as neuroimaging findings [brain computed tomography (CT) or magnetic resonance imaging (MRI)], were also reviewed.

Furthermore, findings were compared between patients aged below 50 years and those aged 50 years or older. Particular attention was given to patients with no prior history of cardiology follow-up or known arrhythmia, who were first diagnosed with arrhythmia during an EEG and subsequently referred for cardiology evaluation.

All arrhythmias observed during EEG recordings were identified and reported by the interpreting physician, a neurologist and clinical neurophysiologist (F.A.I.). In routine clinical practice, neurologists and clinical neurophysiologists report arrhythmic findings detected on the simultaneously recorded single-lead ECG during EEG evaluation. The study workflow and patient selection process are summarized in Figure 1.

Statistical Analysis

We analyzed the data using IBM SPSS Statistics for Windows, version 21.0 (IBM Corp., Armonk, NY, USA). Continuous variables were assessed for normality. Normally distributed data were expressed as mean ± standard deviation and compared using the independent-samples t-test, while non-normally distributed variables were presented as median (range) and analyzed using the Mann-Whitney U test. Categorical variables were presented as numbers and percentages. Group comparisons for categorical variables were performed using the chi-square

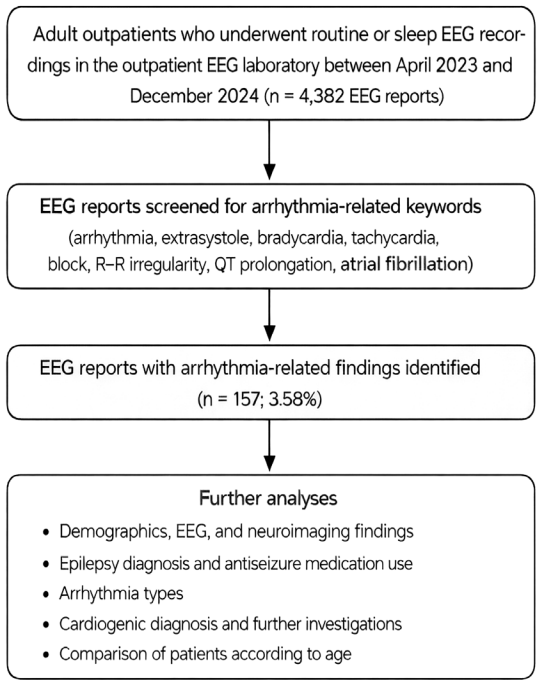

Figure 1. Flowchart shows the study design and EEG report screening process
EEG: Electroencephalograph

test or Fisher's exact test, as appropriate. Correlations between continuous variables were evaluated using Spearman's correlation analysis. A p-value <0.05 was considered statistically significant.

Results

Demographics, EEG, and Neuroimaging Findings

Among 4,382 reviewed EEG reports, 157 (3.58%) included keywords related to arrhythmia. Of these, 134 patients (85.4%) underwent routine EEG recordings, while 23 patients (14.6%) underwent sleep EEG recordings. The mean age of the patients was 57.78±19.61 years (range: 7-89 years). Seventy-one (45.2%) patients were female and 86 (54.8%) were male. Electroencephalography findings were reported as normal in 95 patients (60.5%) and abnormal in 62 patients (39.5%). Among those with abnormal EEG findings, focal or generalized slow-wave paroxysms were observed in 32 patients (51.6%), diffuse slowing in 17 patients (27.4%), epileptiform discharges in 12 patients (19.4%), and an ictal EEG pattern in one patient (1.6%). Neuroimaging (MRI or CT) was performed in 122 (77.7%) patients. Thirty patients (24.6%) had normal findings. Chronic ischemic changes or atrophy were reported in 71 patients (58.2%), while focal lesions (including stroke-related lesions, tumors, and other types) were detected in 21 patients (17.2%).

Epilepsy Diagnosis and Antiseizure Medication Use

An epilepsy diagnosis was confirmed in 53 patients (33.8%) based on medical records. Generalized seizures were the most commonly reported seizure type, occurring in 16 (30.2%) patients, while focal seizures were reported in only two (3.8%) patients. For 35 patients (66.0%), no detailed seizure type was available. The duration of epilepsy was less than one year in 14 (26.4%) patients, between one and five years in 14 (26.4%) patients, more than five years in 16 (30.2%) patients, and unknown in nine (17.0%) patients.

Fifty-seven patients (36.3%) were receiving at least one ASM: 46 (29.3%) were on monotherapy, nine (5.7%) on dual therapy (two ASMs), and two (1.3%) on polytherapy (three or more ASMs). The most frequently used ASMs were levetiracetam (42 patients, 26.8%), carbamazepine (15 patients, 9.6%), valproate (10 patients, 6.4%), lamotrigine (4 patients, 2.5%), and lacosamide (5 patients, 3.2%).

Arrhythmia Types

The most frequently reported arrhythmia types were ES in 55 patients (35.0%); AF in 33 patients (21.0%); bradycardia in 24 patients (15.3%); irregular R-R intervals in 12 patients (7.6%); tachycardia in 7 patients (4.5%); pacemaker rhythm in 4 patients (2.5%); and AV block in 1

patient (0.6%). Unspecified arrhythmias were reported in 21 patients (13.4%).

Patients with abnormal EEG findings had a higher prevalence of AF (30.6%) compared to those with normal EEG findings (21.0%). Conversely, ES was more frequent among patients with normal EEG results (44.3% vs. 21.0%). A significant association was found between EEG abnormalities and the presence of AF (p=0.017). Spearman's correlation analysis showed a significant positive correlation between age and the presence of AF (r=0.413, p<0.001), indicating that older patients are more likely to develop AF.

On the other hand, factors such as unknown spell, diagnosis of epilepsy, epilepsy duration, and ASM use were not significantly associated with the presence or type of arrhythmia (p=0.07, p=0.19, p=0.22, and p=0.59, respectively).

Cardiogenic Diagnosis and Further Investigations

Routine 12-lead ECG was performed in 66 patients (42.0% of the cohort); among these, 27 (17.2% of the cohort) were confirmed to have arrhythmia, while 39 (24.8% of the cohort) had normal ECG findings. Twenty-four-hour Holter monitoring was performed on 22 patients (14.0%); 21 of them (95.5%) showed abnormal results. Echocardiography was conducted in 45 patients (28.7%), revealing abnormalities in 18 cases (40.0%). In addition, 10 patients underwent further cardiac diagnostic procedures, including coronary angiography; all had abnormal findings.

A total of 84 patients had at least one known cardiac diagnosis. Previous arrhythmia diagnosis was present in seven patients (8.2%), hypertension in 31 patients (36.5%), coronary artery disease in 12 patients (14.1%), and valvular heart disease in 11 patients (12.9%). A combination of cardiac conditions was reported in 24 patients (18.2%). Thirty patients (19.2%) were receiving antiarrhythmic medication: beta-blockers (e.g., metoprolol, bisoprolol) in 18 patients (11.5%), amiodarone in 5 patients (3.2%), flecainide in 3 patients (1.9%), and other antiarrhythmics in 4 patients (2.5%). Seventy-five (48.1%) patients were receiving antiplatelet or anticoagulant therapy.

Notably, among patients with arrhythmias on EEG, 3.8% (n=6/157) who had no prior cardiac diagnosis were referred to cardiology after these arrhythmias were identified. These patients underwent further cardiac evaluation, and appropriate antiarrhythmic treatments were initiated. Detailed information about these cases is presented in Table 1.

Comparison of Patients According to Age

Age-related analyses revealed important differences in clinical and electrophysiological findings, which are summarized in Table 2. Although the rate of abnormal EEG findings was similar between the two groups, the distribution of arrhythmia types was significantly different (p<0.001). Atrial fibrillation occurred only in older patients, whereas sinus tachycardia and bradycardia were more common in younger patients. Cardiac comorbidities and the use of cardiac and antiarrhythmic medications were also significantly more common in the older group (p<0.001).

Discussion

The use of a one-channel ECG during routine and sleep EEG is recommended by international guidelines, including those issued by the IFCN and the ILAE. These guidelines primarily emphasize the role of the ECG in identifying extracerebral signals, such as pulse artifacts, which may interfere with accurate EEG interpretation (12). While this is technically useful, it limits the application of ECG to artifact recognition. However, even short single-lead ECG recordings may carry additional diagnostic value. In this study, several clinically significant arrhythmias, including AF and high-frequency ESs, were incidentally identified during EEG monitoring. Some of these arrhythmias were previously undiagnosed and required further cardiological evaluation and treatment. This suggests that routine ECG monitoring during EEG may serve not only as a technical aid but also as a simple, low-cost means of detecting potentially life-threatening cardiac abnormalities. Consistent with this concept, our findings demonstrate that even brief single-lead ECG recordings obtained during routine EEG can reveal clinically relevant arrhythmias, including previously unrecognized conditions requiring cardiological intervention.

Previous studies have reported arrhythmia detection rates on routine EEG ranging from 2% to 28.5% (12,13). In our cohort, the rate was 3.6%, which falls within this range but is at the lower end. Such variation can be explained by methodological differences, such as patient demographics, EEG duration, clinical setting, and expertise in ECG interpretation. For example, Kendirli et al. (14) reported an 18% detection rate in a population enriched for older patients, with longer EEG recordings and cardiologist involvement. Similarly, Onder et al. (15) found a 2% arrhythmia rate when ECGs were reviewed by neurologists; however, in a follow-up study from the same center, this rate nearly doubled when the ECG data were re-evaluated blindly by cardiologists. These findings suggest that systematic review by clinicians with expertise in cardiology can significantly improve the recognition of arrhythmias. Importantly, although only brief single-lead ECG recordings were used in our study, we identified clinically relevant arrhythmias, most commonly ESs. In several cases, these findings led to referral to cardiology and further interventions. These results demonstrate that routine ECG monitoring during EEG, when carefully interpreted, can

Table 1. Clinical characteristics and follow-up of patients without a prior cardiac diagnosis who were referred to cardiology after EEG-detected arrhythmias and subsequently underwent further cardiac evaluation and diagnosis

Patients	Age, gender	EEG type	Diagnosis of patients	EEG findings	ECG findings on EEG	12 lead routine ECG	Holter ECG (24 hours ECG monitoring)	Echocardiographic findings	Antiseizure medications	Other medications	Cardiac follow up
P1	40, Male	Routine	Epilepsy	Abnormal	ES	Normal	Abnormal (3155 VES)	Normal	LEV 500 mg/day, 4 years	-	Beta blocker (bisoprolol 5 mg/day) started
P2	83, Male	Sleep	Seizure disorder, possible epilepsy	Normal	AF	AF	NA	Moderate calcific AS, grade 2 AR, mild MR	LEV 1000 mg/day, 2 years	-	Oral anticoagulation and beta-blocker (metoprolol 50 mg/day) started
P3	8, Female	Sleep	Epilepsy	Abnormal	Frequent ES	Anormal, (LBBB, inf. axis, VES: QRS 120 ms and compensatory pause)	Abnormal (frequent VES: 14% of all recording)	Normal	CBZ 600 mg/day, 3 years (previously on VPA 1000 mg/day)	-	Beta-blocker (propranolol 45 mg/day) started
P4	53, Male	Sleep	Epilepsy	Normal	Frequent ES	Anormal (VES)	Abnormal (25.000 VES)	VES related cardiomyopathy	LEV 750 mg/day (1 year)	-	Beta-blocker (bisoprolol 5 mg/day) started
P5	44, Male	Routine	Epilepsy, DM	Normal	Frequent ES (>1/min)	Normal	Abnormal (4637 VES and 18 SVAE)	NA	LEV 1000 mg/day (3 years)	-	Beta-blocker (metoprolol 50 mg/day) started
P6	22, Male	Sleep	Possible epilepsy, PNES, ET, depression, OCD	Normal	ES	NA	Abnormal (311 SVEA)	Normal	VPA 1000 mg/day (2 years)	Aripiprazole 20 mg/day fluoxetine 60 mg/day quetiapine 400 mg/day	Beta-blocker (metoprolol 25 mg/day) started

AF: Atrial fibrillation, AR: Aortic regurgitation, AS: Aortic stenosis, CBZ: Carbamazepine, DM: Diabetes mellitus, ECG: Electrocardiography, EEG: Electroencephalography, ES: Extrasystole, ET: Essential tremor, F: Female, LBBB: Left bundle branch block, LEV: Levetiracetam, M: Male, MR: Mitral regurgitation, NA: Not available, OCD: Obsessive-compulsive disorder, PNES: Psychogenic non-epileptic seizure, SVEA: Supraventricular extrasystolic activity, VES: Ventricular extrasystole, VPA: Valproic acid

Table 2. Comparison of demographic, clinical, and electrophysiological findings between patients aged <50 and ≥50 years with EEG-detected arrhythmias

	Age <50 years n=41	Age ≥50 years n=116	p-value
Gender Female Male	 17 (41.5%) 24 (58.5%)	 54 (46.6%) 62 (53.4%)	0.57
Abnormal EEG	14 (34.1%)	48 (41%)	0.41
Arrhythmia type - Extrasystole (ES) - Atrial fibrillation (AF) - Sinus bradycardia - Irregular R-R intervals - Sinus tachycardia - Atrioventricular block - Unspecified arrhythmias	 19 (46.3%) 1 (2.4%) 5 (12.2%) 6 (14.6%) 5 (12.2%) 1 (2.4%) 4 (9.8%)	 36 (31%) 32 (27.6%) 19 (16.4%) 6 (5.2%) 2 (1.7%) 0 17 (14.7%)	<0.001
Cardiology visit	16 (39%)	59 (50.9%)	0.19
EEG type Routine EEG Sleep EEG	 27 (65.9%) 14 (31.1%)	 107 (92.2%) 9 (7.8%)	<0.001
Holter ECG Abnormality on Holter	7 (17.1%) 7 (100%)	15 (12.9%) 14 (93.3)	0.5 0.4
Echocardiography Abnormality on echocardiography	8 (19.5%) 2 (25%)	37 (31.9%) 16 (43.2%)	0.1 0.4
Further cardiac investigations Abnormal findings	1 (2.4%) 1 (100 %)	9 (7.8%) 9 (100 %)	0.4
Cardiac comorbidities	9 (33.3%)	75 (66.7)	<0.001
Other comorbidities	23 (82.1%)	88 (87.1%)	0.5
Diagnosis of epilepsy	18 (43.9%)	35 (30.2%)	0.1
Antiseizure medication use	19 (46.3%)	38 (32.8%)	0.1
Any cardiac medication use	9 (22.5%)	80 (69%)	<0.001
Antiarrhythmic medication use	5 (12.5)	25 (21.6)	<0.001
Neuroimaging abnormalities - Normal findings - Chronic ischemic lesions - Focal lesions	24 (58.5%) 18 (75%) 5 (20.8) 1 (4.2%)	98 (84.5%) 12 (12.2%) 66 (67.3%) 20 (20.4%)	0.001

Categorical variables were compared using the chi-square test or Fisher's exact test, as appropriate
ECG: Electrocardiography, EEG: Electroencephalography

offer useful diagnostic insights beyond its traditional role. In our cohort, despite shorter EEG durations and the absence of systematic cardiology review, arrhythmias with direct clinical consequences were still detected, underscoring the real-world relevance of EEG-coupled ECG evaluation.

Routine outpatient EEG is widely used not only in the evaluation of epilepsy but also in the differential diagnosis of various paroxysmal events, including those of neurological, psychiatric, or cardiogenic origin (16). Its low cost, accessibility, and non-invasive nature make it a practical tool in a broad range of clinical settings (17). In this context, the ECG channel embedded in EEG recordings can provide critical diagnostic clues beyond artifact recognition. Several studies have shown that cardiac arrhythmias, particularly those that mimic seizures, may be detected incidentally on EEG. Zaidi et al. (2) demonstrated that a significant proportion of patients initially diagnosed with epilepsy were later found to have cardiac syncope, and Tekin et al. (18) reported two cases of patients who had seizure-like episodes and asystole captured during their attacks on routine EEG monitoring, which led to life-saving cardiologic interventions. These findings underscore the importance of systematic ECG evaluation during EEG in patients with unexplained transient loss of consciousness.

In our study, ESs were the most frequently detected arrhythmia, followed by AF, which was observed predominantly in patients aged ≥50 years. This distribution is consistent with previous studies reporting an increased prevalence of AF with advancing age, particularly after the age of 60, with a marked rise observed in each subsequent decade. Additionally, the presence of cardiovascular comorbidities supports the notion that age may play

a significant role in both diagnostic and therapeutic strategies (19). Although ES is often considered a benign finding, its incidental detection during EEG should not be overlooked. As shown in Table 1, five patients with no known cardiac history were referred to cardiology after ES was observed on EEG. All underwent further evaluation, and pharmacological treatment was initiated for those with frequent ES. For example, in one patient (Patient 4), 24-hour Holter ECG monitoring revealed more than 25,000 ES episodes, leading to antiarrhythmic therapy. In another case (Patient 2), a new diagnosis of AF was made, and anticoagulant therapy was started after cardiology referral—a potentially life-saving intervention. Given the established link between AF and thromboembolic risk, these findings highlight the importance of routine ECG evaluation during EEG recordings.

Cardiovascular comorbidities, including various arrhythmias, are relatively common in PWE (5,20,21). Several mechanisms have been proposed to explain this co-occurrence. Some arrhythmias, such as ictal asystole, may develop during seizures because of brain-heart axis interactions and autonomic dysfunction (8,22). Additionally, interictal arrhythmias may arise due to shared genetic susceptibilities, such as ion channelopathies that affect both the cardiac and nervous systems. Certain ASMs, particularly sodium channel blockers, have also been linked to cardiac conduction abnormalities (21). Although statistical associations were not demonstrated, the frequent observation of ESs and AF among PWE in our cohort suggests that EEG-based ECG screening may still have practical clinical value in this population.

Epidemiological data indicate that the risk of arrhythmia is approximately 1.36-fold higher in PWE than in the general population, with an even greater risk reported among those on ASMs (23). In our cohort, approximately one-third of patients had a confirmed diagnosis of epilepsy, and 36% were receiving ASMs. Although no statistically significant association was found between epilepsy or ASM use and specific arrhythmia types—possibly owing to the limited sample size and a neurological rather than cardiological interpretation—ES and AF were frequently observed among PWE. Notably, in one case, AF was identified for the first time during an EEG recording that coincided with ictal activity, leading to a cardiology referral and the initiation of anticoagulation therapy. Although major ictal arrhythmias such as asystole or bradycardia were not observed, likely because routine EEG sessions are brief, our findings emphasize the diagnostic and clinical value of systematic ECG assessment in PWE. Even brief ECG segments embedded within EEG recordings may uncover clinically relevant cardiac abnormalities, contributing to improved patient management and safety.

In this study, most arrhythmias identified during EEG were not evident on brief, routine ECG recordings. However, extended cardiac monitoring subsequently confirmed these findings in nearly 90% of cases. This highlights the diagnostic value of prolonged EEG recordings with ECG channels, which may uncover rhythm disturbances that short-term ECG could miss. As demonstrated in Table 1, some patients without a prior cardiac diagnosis had clinically significant arrhythmias during EEG monitoring, resulting in cardiology referral and initiation of treatment. These observations underscore the potential role of EEG-detected arrhythmias in guiding diagnostic and therapeutic strategies and reducing morbidity. Our findings indicate that arrhythmias detected incidentally during EEG—particularly in patients without a known cardiac history—may represent an important opportunity for timely diagnosis and intervention.

Study Limitations

This study has some limitations. Since it is a retrospective, single-center study, there may be selection and information bias, and the generalizability of the findings may be limited. Arrhythmias were detected using a single-lead ECG integrated into the EEG system, a method that is less sensitive than a standard 12-lead ECG or Holter monitoring. In addition, the lack of multivariable analysis is another limitation, as independent predictors of arrhythmia could not be determined because of the study's descriptive design and the limited sample size for certain variables. Not all patients were evaluated by the cardiology service or underwent standardized cardiac testing, which might have led to underreporting of arrhythmias. Additionally, ECG findings were interpreted by a single neurologist, which may have limited the identification of subtle arrhythmic patterns. Finally, due to the lack of long-term follow-up, the prognostic significance of the detected arrhythmias could not be fully assessed.

Despite these limitations, this study has several important strengths. It includes a large real-world cohort of adult outpatients undergoing routine and sleep EEG recordings, thereby reflecting daily clinical practice. The screening of a large number of EEG reports enabled the systematic evaluation of incidental arrhythmias detected on EEG. All EEGs were acquired using standardized recording protocols and interpreted by a single experienced clinical neurophysiologist, ensuring consistency in EEG and ECG assessments. In addition, the study highlights the clinical relevance of incidental arrhythmias detected on EEG and demonstrates their potential impact on further cardiological evaluation and patient management, particularly in patients without a prior cardiac diagnosis.

Conclusion

While neurologists meticulously analyze EEG waveforms, equal attention should be given to the accompanying ECG recordings. In PWE or those undergoing differential diagnosis of paroxysmal events, identification of arrhythmias during EEG provides a simple, cost-effective, non-invasive means to improve diagnostic accuracy and clinical management. Furthermore, for individuals without a known cardiac history, even a 20-30-minute period of ECG monitoring during EEG recordings may help detect otherwise unrecognized cardiac abnormalities.

Ethics

Ethics Committee Approval: Ethical approval was obtained from the Scientific Research Ethics Committee No. 2 of the Basaksehir Cam and Sakura City Hospital (approval no: 2025-56, date: 26.02.2025).

Informed Consent: Due to its retrospective design, the requirement for informed consent was waived by the ethics committee. All patient data were anonymized prior to analysis.

Footnotes

Authorship Contributions

Surgical and Medical Practices: F.A.I., Concept: F.A.I., Design: F.A.I., D.K., R.O., Data Collection or Processing: F.A.I., D.K., R.O., Analysis or Interpretation: F.A.I., Literature Search: F.A.I., D.K., R.O., Writing: F.A.I.

Conflict of Interest: No conflicts of interest were declared by the authors.

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