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Abnormal EEG in Patients with Brugada Syndrome

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ABSTRACT

Background: A few studies have examined electroencephalogram (EEG) patterns in patients suffering Brugada syndrome (BS). We aimed to investigate the brain EEG characteristics in patients with BS and compare it with patients with Vasovagal Syncope (VVS) as the control.

Methods: The present cross-sectional study was performed on 33 patients suffering BS that referred to medical centers affiliated with Shiraz University of Medical Sciences from 2011 to 2017.Also, 28 age-matched patients who suffering VVS were included as the controls. EEG assessment was obtained for all participants.

Results: EEG abnormalities were found in 6.6% of patients suffering BS, however such changes were not observed in control group suffering VVS (p = 0.498). The overall rate of ventricular arrhythmia requiring ICD was 33.3% in BS group and 0% in VVS indicating significantly higher rate of such arrhythmia in former group (p = 0.005). Abnormal electrocardiogram pattern could be revealed in two patients with concomitant BS and epilepsy as coved ST segment elevation and T inversion in pericardial leads.

Conclusion: The EEG abnormalities is a finding revealed in 6.6% of patients suffering BS, but uncommon in patients with VVS. The prominent clinical sequel in BS patients is ventricular arrhythmia requiring ICD implantation detecting in one-third of affected patients.

Keywords: electroencephalogram; Brugada syndrome; Vasovagal Syncope

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INTRODUCTION

Syncope is the transient loss of consciousness caused by cerebral hypoperfusion, which is characterized by rapid onset, a short period of time, as well as complete and spontaneous recovery (1). The Vasovagal Syncope (VVS) is a reflex syncope created by emotional or orthostatic stress and is typically triggered by a background of activating autonomic system and thus may be manifested by sweating, pallor, and nausea (2). In reflex syncope, circulatory-controlled cardiovascular reflexes are disrupted, leading to a drop in blood pressure or bradycardia (3). In the pathophysiology of reflex syncope, a standing position causes 1 liter of blood to collect in the lower limbs and splenic area that reduces venous return, ventricular preload, and cardiac output (4). The resulting hypotension and bradycardia leading reduce in cerebral blood flow and impair brain and nervous system function (5). However, the relationship between brain involvement and possible neurological damage associated with VVS is not yet fully understood. Different studies have shown the presence of EEG abnormalities during the Head-up tilt test, which is a stimulus test to create the VVS (6-8). So far, no study has examined the EEG of known patients in the VVS outside the syncope.

Since introducing as a clinical disorder in 1992, Brugada syndrome (BS) has attracted a great deal of attention due to its high incidence in many parts of the world and its association with the high risk of sudden death in young and healthy adults and with low prevalence in infants (9,10). BS is an inherited arrhythmogenic disorder characterized by increased elevation of ST segment in right pericardial leads on electrocardiogram (ECG), no structural heart disease, and increased risk of ventricular fibrillation (VF) and sudden cardiac death (SCD) (11). There is growing evidences on mild structural abnormalities in the right ventricular outflow tract that provide the basis for arrhythmias in BS (12). Although the association of BS with brain disorders has been little studied, little information is available on this relationship. Some studies have reported cases of BS associated with febrile seizures (13), status epilepticus (14), and epilepsy. Hung and colleagues described seizures as one of the manifestations of the disease in Brugada syndrome. Although seizures are an uncommon manifestation of the disease (15), in some cases static epilepticus has been the primary manifestation of patients with BS. Due to the high prevalence of this syndrome in Asia compared to other regions (16), and the pattern of familial inheritance of sodium channel disorders and the high prevalence of consanguineous marriage in our country, very little information is available about this disease. Also, few studies have examined EEG in the category of patients with BS. The aim of this study was to investigate the brain EEG characteristics in patients with BS and compare it with patients with VVS as a control group to investigate the relationship between this syndrome and neurological disorders.

MATERIALS AND MERTHODS

The present cross-sectional study was performed on 33 patients suffering BS that referred to medical centers affiliated with Shiraz University of Medical Sciences from 2011 to 2017.Also, 28 age-matched patients who suffering VVS were included as the controls. The history of hemorrhagic brain stroke in the control and target groups was considered as the exclusion criteria. The BS was definitively diagnosed based on the presence of Right Bundle Branch Block and ST segment elevation at precordial leads. The diagnosis of VVS was made if a trigger (such as fear, pain, and long standing) was associated with prodromal signs and symptoms (such as nausea, light-headedness, and diaphoresis), or if a less typical history was confirmed by a positive tilt-table test. Echocardiographic studies and other imaging methods showed no structural abnormalities in the heart of all patients. Initial patient information such as age, sex, cause of seizure, and history of seizures were evaluated. For all included patients in both groups, EEG assessment was obtained and the results were interpreted by a single high experienced neurologist. The study endpoint was to assess and compare any EEG abnormality in both BS and VVS groups.

For statistical analysis, results were presented as mean ± standard deviation (SD) for quantitative variables and were summarized by frequency (percentage) for categorical variables. Categorical variables were compared using chi-square test. P values of ≤ 0.05 were considered statistically significant. For the statistical analysis, the statistical software SPSS version 24.0 for windows (IBM, Armonk, New York) was used.

RESULTS

In this study, 33 patients with BS and 28 patients suffered VVS were included into current study. The average age of patients was 24 ± 11 years and 31 ± 6 years respectively indicating no significant difference (p = 0.124). As shown in Table 1, epilepsy as an EEG abnormality was revealed in 6.6% of BS patients and in none of the cases with VVS without statistical difference between the two groups (p = 0.498). Overall, EEG abnormalities were found in 6.6% of patients suffering BS, however such changes were not observed in control group suffering VVS (p = 0.498). In this regard, the overall rate of Ventricular arrhythmia requiring ICD was 33.3% in BS group and 0% in VVS indicating significantly higher rate of such arrhythmia in former group (p = 0.005). Figure 1 presents ECG pattern in two patients with concomitant BS and epilepsy. The model, previously described as a Type 1 ECG model, includes a coved ST segment elevation with a value of> 0.2 mV in pericardial leads V1 and V2, and in some cases V3, which ends with an invert T wave.

DISCUSSION

Sudden Unexpected Death in Epilepsy (SUDEP) refers to deaths in people with epilepsy that are not caused by injury, trauma, drowning, or other known causes. The pathophysiological approach attributed to SUDEP includes central apnea, autonomic dysfunction of cerebral and cardiac blood flow, decreased heart rate, and neurogenic pulmonary edema (17). Tachycardia, arrhythmic bradycardia, asystole, atrial fibrillation, supraventricular tachycardia, and ventricular atrial block are commonly reported in the inter-ictal, ictal, and post-ictal phases in patients with epilepsy. However, the exact role of these rhythm disorders in the development of SUDEP has not been clarified. However, there is evidence that long-term epilepsy can cause physiological and anatomical changes in the autonomic nervous system and lead to various cardiac changes associated with arrhythmias (18). BS is a growing topic in the field of emergency medicine, cardiology, and more recently neurology. It is estimated that about 50% of sudden deaths are due to cardiac arrhythmias without structural abnormalities in healthy young people. Since its introduction as a new disease in 1992, BS has attracted a great deal of attention among physicians and basic science researchers (15). Currently, the diagnosis of this syndrome is based on a set of clinical events (syncope or sudden death from malignant ventricular arrhythmias) and electrocardiographic features (increased pathogenic elevation of the ST segment) (19). In recent years, many advances have been made in the field of genetic knowledge and cellular mechanisms responsible for the characteristics of classical electrocardiograms and sensitivity to ventricular arrhythmias. ICD is recognized as the only treatment option with efficacy confirmed in primary and secondary prevention of sudden arrhythmia death in these patients. In the absence of effective drug treatment, ICD is considered the primary treatment in BS for primary prevention in many patients with this syndrome (20). Due to the fact that the risk of SCD remains relatively low in asymptomatic patients (0.5 to 1.5 percent per year) and the rate of complications related to ICD is high in this young population, the use of this method of prevention as a major challenge for physicians in identifying patients at risk for arrhythmias requiring specific treatment (21). As a result, according to the results of the present study, in only 33% of patients, indications for the use of this method of prevention led to its use.

Syncope is widely known as a bad prognostic indicator in BS. However, young people with the disease may suffer from VVS instead of arrhythmias. Accompanying BS and neurological and cerebral disorders have been reported in limited studies (22). Fauchier et al in their study of BS and epilepsy syndrome stated that, given the genetic nature of the disorders, the sodium channel disorders of the heart cells in BS, which manifests itself in the form of electrophysiological disorders in this organ. The presence and importance of similar channels in neurons, disorders such as BS, play a role in sudden death in epileptic patients, and on the other hand, the presence of nervous system disorders in patients with this syndrome is important (23). The most important neurological disorder reported in patients with BS after epilepsy is VVS. Baum and colleagues reported the simultaneous presence of BS and seizures as the first symptoms in a 15-year-old patient (24). In another study, Asif Ali and colleagues studied the disease for the first time with tonic-clonic seizures, urinary incontinence, and ventricular tachycardia, and electrocardiographic studies showed that the patient had BS (25). Girad et al in a study

on epilepsy patients diagnosed with BS in a simultaneous EEG and cardiac telemetry study showed that the patient's seizures were not caused by a decrease in cerebral perfusion, but they attributed the disturbance to simultaneous channelopathy in the cell's sodium channels in nerves and heart (26). The results of the present study also indicate the presence of abnormal waves in time from outside the seizure in EEG studies in two patients with BS and epilepsy. Also, patients with VVS did not show this abnormality in their EEG and no case of seizures were observed in this group.

The high prevalence of this syndrome in the region and the simultaneous presence of neurological disorders show the high importance of neurological studies in patients with BS. As shown in the present study, 6.6% of patients with Brugada syndrome showed concomitant epilepsy and cerebral band disorders, while epilepsy was not observed in the control group at the same time, EEG was normal in all these patients. So far, no study has examined the prevalence of neurological disorders in patients with BS. Considering the results of the present study and the limitation in similar studies in this field and the importance of diagnosing brain and neurological disorders in patients with BS in order to diagnose and prevent the occurrence of non-preventable complications and treatment, more studies are needed to be done in this field.

CONCLUSION

The EEG abnormalities is a finding revealed in 6.6% of patients suffering BS, but uncommon in patients with VVS. The prominent clinical sequel in BS patients is ventricular arrhythmia requiring ICD implantation detecting in one-third of affected patients. It seems that the presence of such abnormalities can be linked to the pathophysiology and prognosis of BS requiring further evaluations.

CONFLICT OF INEREST

None

REFERENCES

1. Bassetti CL. Transient Loss of Consciousness and Syncope. Handb Clin Neurol. 2014;119:169-91. doi: 10.1016/B978-0-7020-4086-3.00013-8. PMID: 24365296.
2. Sutton R. Reflex syncope: Diagnosis and treatment. J Arrhythm. 2017 Dec; 33(6): 545–552. PMID: 29255499
3. Patel RP, Quinn JV. Syncope: a review of emergency department management and disposition. Clin Exp Emerg Med. 2015 Jun; 2(2): 67–74. PMID: 27752576
4. Adkisson WO, Benditt DG. Pathophysiology of Reflex Syncope: A Review. J Cardiovasc Electrophysiol. 2017 Sep;28(9):1088-1097. doi: 10.1111/jce.13266. PMID: 28776824.
5. Brignole M. Diagnosis and treatment of syncope. Heart. 2007 Jan; 93(1): 130–136. PMID: 17170354
6. Brenner RP. Electroencephalography in Syncope. J Clin Neurophysiol. 1997 May;14(3):197-209. PMID: 9244159
7. Dantas FG, Cavalcanti AP, Rodrigues Maciel BD. The Role of EEG in Patients With Syncope. J Clin Neurophysiol. 2012 Feb;29(1):55-7. doi: 10.1097/WNP.0b013e318246b589. PMID: 22353986.
8. Ammirati F, Colivicchi F, Di Battista G, Garelli F, Santini M. Electroencephalographic Correlates of Vasovagal Syncope Induced by Head-Up Tilt Testing. Stroke. 1998 Nov;29(11):2347-51. doi: 10.1161/01.str.29.11.2347. PMID: 9804646.
9. Sheikh AS, Ranjan K. Brugada syndrome: a review of the literature. Clin Med (Lond). 2014 Oct; 14(5): 482–489. PMID: 25301907.
10. Li C, Lee S, Yin C, Liu T. Brugada syndrome: A comprehensive review of pathophysiological mechanisms and risk stratification strategies. Int J Cardiol Heart Vasc. 2020 Feb; 26: 100468. PMID: 31993492.
11. Brugada P, Brugada J. Right bundle branch block, persistent ST segment elevation and sudden cardiac death: a distinct clinical and electrocardiographic syndrome. A multicenter report. J. Am. Coll. Cardiol. 1992 Nov 15;20(6):1391-6.
12. Sarquella-Brugada G, Campuzano O, Arbelo E, Brugada J, Brugada R. Brugada syndrome: clinical and genetic findings. Genet. Med. 2016 Jan;18(1):3-12.
13. Madeira M, Caetano F, Providencia R, Almeida I, Trigo J, Nascimento J, et al. Fever-induced type 1 Brugada pattern. Revista portuguesa de cardiologia : orgao oficial da Sociedade Portuguesa de Cardiologia = Portuguese journal of cardiology : an official journal of the Portuguese Society of Cardiology. 2015;34(4):287.e1-7. Epub 2015/04/07. doi: 10.1016/j.repc.2014.10.002. PubMed PMID: 25843309.
14. Ali A, Iliescu CA, Smalling RW. Brugada Syndrome in a Black Man with Seizures and Urinary Incontinence. Texas Heart Institute Journal. 2006;33(2):273.
15. Girard S, Cadena A, Acharya Y. Woman with Brugada syndrome and epilepsy: a unifying diagnosis? Southern medical journal. 2008;101(11):1150-3.
16. Kamakura S. Epidemiology of Brugada syndrome in Japan and rest of the world .Journal of Arrhythmia. 2013;29(2):52-5.
17. Parisi P, Oliva A, Coll Vidal M, Partemi S, Campuzano O, Iglesias A, et al. Coexistence of epilepsy and Brugada syndrome in a family with SCN5A mutation. Epilepsy Res. 2013;105(3):415-8. doi: 10.1016/j.eplepsyres.2013.02.024. PubMed PMID: 23538271.
18. Sandorfi G, Clemens B, Csanadi Z, editors. Electrical storm in the brain and in the heart: epilepsy and Brugada syndrome. Mayo Clinic proceedings; 2013: Elsevier.
19. Johnson J, Hofman N, Haglund C, Cascino G, Wilde A, Ackerman M. Identification of a possible pathogenic link between congenital long QT syndrome and epilepsy. Neurology. 2009;72(3):224-31
20. Velagapudi P, Turagam M, Laurence T, Kocheril A. Cardiac arrhythmias and sudden unexpected death in epilepsy (SUDEP). Pacing and Clinical Electrophysiology. 2012;35(3):363-70
21. Letsas KP, Sideris A, Efremidis M, Pappas LK, Gavrielatos G, Filippatos GS, et al. Prevalence of

paroxysmal atrial fibrillation in Brugada syndrome: a case series and a review of the literature. Journal of cardiovascular medicine (Hagerstown, Md). 2007;8(10):803-6. Epub 2007/09/22. doi : /10.2459JCM.0b013e3280112b21. PubMed PMID: 17885518

22. Camacho Velasquez JL, Rivero Sanz E, Velazquez Benito A, Mauri Llerda JA. Epilepsy and Brugada syndrome. Neurologia (Barcelona, Spain). 2017;32(1):58-60. Epub 2015/06/04. doi: 10.1016/j.nrl.2015.03.010. PubMed PMID: 26037409.
23. Fauchier L, Babuty D, Cosnay P. Epilepsy, Brugada syndrome and the risk of sudden unexpected death. Journal of neurology. 2000;247(8):643-4. Epub 2000/10/21. PubMed PMID: 11041334.
24. Baum B, Ingaramo O, Chao D. Adolescent Seizure in the Emergency Department Due to Concomitant Brugada Syndrome. Pediatric emergency care. 2018;34(8):e144-e6. Epub 2018/05/26. doi: 10.1097/pec.0000 .PubMed PMID: 29794950.
25. Ali A, Iliescu CA, Smalling RW. Brugada Syndrome in a Black Man with Seizures and Urinary Incontinence. Texas Heart Institute Journal. 2006;33(2):273.
26. Girard S, Cadena A, Acharya Y. Woman with Brugada syndrome and epilepsy: a unifying diagnosis? Southern medical journal. 2008;101(11):1150-3

Table 1: Comparing clinical characteristics in BS and vasovagal syncope groups

Characteristics	Brugada syndrome (n = 33)	Vasovagal syncope (n = 28)	*P*
Gender, %			0.602
Male	17 (51.5)	18 (64.3)	
Female	16 (48.5)	10 (35.7)	
Mean age, year	24 ± 11	31 ± 6	0.124
Prevalence of epilepsy, %	2 (6.6)	0 (0.0)	0.498
Abnormal EEG	2 (6.6)	0 (0.0)	0.498
Ventricular arrhythmia requiring ICD	11 (33.3)	0 (0.0)	0.005

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