Case Report

Biventricular Noncompaction Cardiomyopathy in a Patient Presenting with New Onset Seizure: Case Report

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Ventricular noncompaction (VNC) of the myocardium is a rare genetic cardiomyopathy caused by a disorder during endocardial morphogenesis and could be accompanied by life-threatening complications. The major clinical manifestations of VNC are heart failure, arrhythmias, and embolic events. The left ventricle is the most commonly reported affected site, but a few cases of right ventricular involvement have also been reported. We report a case of biventricular noncompaction cardiomyopathy in a 31-year-old woman presenting with a new onset seizure. On the second day of her telemetry-monitored hospitalization, she suffered a witnessed ventricular fibrillation arrest requiring emergency direct-current cardioversion and induced hypothermia. Transthoracic echocardiography (TTE) showed isolated left ventricular (LV) noncompaction and depressed LV systolic function. Subsequent cardiac magnetic resonance imaging (MRI) revealed both left and right ventricular noncompaction. This unusual presentation highlights the importance of a complete and thorough evaluation of patients even when presenting with apparently noncardiac symptom(s).

1. Introduction

Ventricular noncompaction (VNC) of the myocardium is a rare genetic cardiomyopathy that is believed to arise from arrested endomyocardial development during embryogenesis [1]. It is a rare idiopathic cardiomyopathy with an incidence of about 0.05% [2, 3]. VNC is classified by the American Heart Association as a primary genetic cardiomyopathy [1] and is characterized by an altered myocardial wall with prominent trabeculae and deep intertrabecular recesses. This results a thickened bilayer of compacted and noncompacted myocardium [4], caused by the arrest of the normal process of endomyocardial morphogenesis. The normal process of trabeculation has been shown to be dependent upon secretion of neuregulin growth factors from the endocardium. Angiogenic factors, such as vascular endothelial growth factor and angiopoietin-1, may also be critical for normal trabeculae formation [5, 6]. The major clinical manifestations of VNC are heart failure, arrhythmias, sudden cardiac death, cardioembolic events, and syncope [7–9]. To our knowledge, seizures have not been previously reported as a manifestation of this condition. Here, we report a case of biventricular noncompaction cardiomyopathy in a young female presenting with new-onset tonic-clonic seizure.

2. Case Presentation

A 31-year-old woman presented with a witnessed loss of consciousness while driving. The episode lasted for about five-to-ten minutes and was associated with tonic-clonic seizure-like movement. There was no urinary or bowel incontinence. She had no history of seizures, arrhythmias, or family history of sudden cardiac death.

Physical exam was remarkable only for a 2/6 systolic ejection murmur loudest at the left midsternal border on
cardiac auscultation. The laboratory results were within normal limits. Electrocardiogram (ECG) showed sinus rhythm with occasional premature ventricular complexes. An electroencephalogram (EEG) and a head-computed tomography (CT) scan were unrevealing.

In the course of the workup, the patient suffered a ventricular fibrillation cardiac arrest requiring defibrillation and induced hypothermia for resuscitation. She recovered without neurologic deficits. Cardiac evaluation with echocardiogram (Figure 1) showed depressed left ventricular systolic function (ejection fraction (EF) of 30–35%), biatrial enlargement, and increased left ventricular (LV) wall thickness. The left ventricular wall showed marked trabeculation within the inner layer of myocardium consistent with LV noncompaction cardiomyopathy. Contrast study showed blood flow through the trabeculated noncompact inner layer to the outer compact layer. Cardiac MRI (Figure 2) demonstrated the prominent LV trabeculation pattern that was noted on TTE, which forms the classic spongiform appearance on the distal one-third of the LV cavity. In addition, an equally prominent trabeculation pattern was seen in the right ventricle (RV) involving the distal one-third of the RV. Since other MRI features of arrhythmogenic RV dysplasia were absent, the MRI findings were consistent with biventricular noncompaction. A single-lead ICD was implanted and the patient was later discharged in stable condition.

3. Discussion

VNC of the myocardium is a rare genetic cardiomyopathy. The left ventricle is more frequently involved, but biventricular involvement, as in this case, is rarely encountered [10, 11]. What made our patient unique were not only the individual diagnostic findings, but also the aggregate clinical picture. Oechslin et al. [7] demonstrated in a follow-up study of 34 patients that the most important clinical manifestations of VNC were heart failure (53%), ventricular tachycardia (41%), sudden cardiac death (35%), syncope (18%), and embolic events (24%). Our patient presented solely with a tonic-clonic seizure-like activity and a normal EKG and EEG, but later experienced an in-hospital ventricular fibrillation cardiac arrest. Among all the presenting symptom of VNC, the most common reason for referral was heart failure, [6, 7] with one-third of these patients having NYHA class III/IV at time of diagnosis [12]. Our patient did not have signs or symptoms of heart failure on presentation. However, this
does not exclude the fact that she had an asymptomatic cardiomyopathy.

Although tonic-clonic seizure-like activity was the only presenting symptom given the extensive structural heart disease, it is plausible that this patient likely had a ventricular arhythmia event (since the EEG and ECG were unremarkable) leading to generalized cerebral hypoxia, and thus the tonic-clonic seizure activity. The resulting motor activity has been attributed to a decreased cerebral blood flow [13], which results in generalized cerebral hypoxia and thus mimicking epileptic seizures. Schott et al. [17] identified cardiac arrhythmias in 20% of the patients referred with idiopathic epilepsy. Patients with VNC are at an increased risk for thromboembolic events [18]. However, in the absence of atra fibrillation or LV systolic dysfunction, the risk for cardioembolic event is rare [19]. Seizure may be an associated complication following an acute stroke [20]. Even though our patient had a negative CT scan of the head, it is conceivable that a thromboembolic event was a plausible cause for the seizure.

Although left ventricular noncompaction is more common, the improved imaging capabilities of cardiac MRI provide opportunity for better characterization of right ventricular involvement. Echocardiography has a crucial role in the diagnosis of VNC, but cardiac MRI, contrast ventriculography, and computed tomography could also be utilized during assessment, especially in patients with poor image quality on echocardiography [21, 22], in order to rule out other cardiac pathological involvement. Borreguero et al. [23] suggested the potential role of cardiac MRI in the evaluation of the RV with noncompacted myocardium. Our patient represents an important example of biventricular noncompaction cardiomyopathy, in which cardiac MRI aided the diagnosis.

In conclusion, VNC is an uncommon disorder accompanied by life-threatening complications. Its unusual presentation highlights the importance of a complete and thorough workup of patients presenting with apparently noncardiac symptom(s). Data is limited on specific therapy for VNC, but it is recommended that medical management be tailored towards the clinical manifestations, and standard guidelines should be applied for patients with reduced LVEF, and heart failure with preserved systolic function [24], in the setting of VNC. Patients with VNC, who meet standard criteria for antiocoagulation, should also be managed according to standard guidelines [25]. In addition, periodic holter monitoring may be used to assess the risk for asymptomatic arrhythmias. Finally, patients with VNC should receive implantable cardioverter-defibrillator (ICD) therapy according to standard indications for primary and secondary prevention of sudden cardiac arrest [26, 27].

**Conflict of Interests**

The authors declare that they have no competing interests.

**Authors’ Contributions**

O. Odiete conceived the study, substantially involved in the acquisition of data, compilation of relevant literature, and drafted the preliminary and final paper. R. Nagendra was the cardiologist on consults, who read the echocardiogram, and was involved in the provisional and final diagnosis. He also reviewed the paper. M. Lawson read the cardiac MRI and was involved in the final diagnosis as well as proofreading the paper. H. Okarof was involved intellectually in the revision, formatting and proofreading the paper. All authors have read and approved the final version of the paper.

**Consent**

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

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