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Original Article

Electrocardiographic (ECG) clues to differentiate idiopathic right ventricular outflow tract tachycardia (RVOTT) from arrhythmogenic right ventricular cardiomyopathy (ARVC)

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ABSTRACT

Introduction: Arrhythmogenic right ventricular cardiomyopathy/dysplasia (ARVC/D) is a genetic cardiomyopathy that most commonly affects young adults. The most commonly observed reason of death in patients suffering from ARVC/D is sudden cardiac death (SCD). On the other hand, idiopathic right ventricular outflow tract tachycardia (RVOT VT) usually has a benign course. Both of the entities may have ventricular tachycardia (VT) with left bundle branch block (LBBB) pattern and inferior axis. We tried to propose new discriminating electrocardiographic indices for differentiation of foretold entities.

Material and method: This was a retrospective study. We reviewed records of patients admitted between 2003 and 2012 with the diagnosis of either ARVC/D or RVOT VT that presented with VT (LBBB morphology).

Result: A total of fifty nine patients (30 RVOT VT and 29 ARVC/D) were enrolled. In ARVC/D group, men were dominant while the reverse was true of RVOT VT. Palpitation was more common in the RVOT VT group (90% vs. 66.7%), but aborted SCD and sustained VT were more common in ARVC/D group. The new ECG criteria proposed by us mean QRS duration in V1–V3, QRS difference in right and left precordial leads, S wave upstroke duration, JT interval dispersion, QRS and JT interval of right to left precordial leads were all significantly longer in ARVC/D when compared to RVOT VT patients ($p < 0.001$).

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Conclusion: The proposed ECG criteria can be used for non-invasive diagnosis of ARVC/D and incorporation in the future updates of ARVC/D task force criteria.

1. Introduction

Arrhythmogenic right ventricular cardiomyopathy/dysplasia (ARVC/D) is characterized by progressive replacement of ventricular myocytes with variable amounts of fibrous and adipose tissue. This patchy involvement is mostly located in right ventricular (RV) inflow–outflow tract and apex, which predisposes patients to ventricular premature depolarization, non-sustained or sustained ventricular tachycardia (VT) and even ventricular fibrillation leading to sudden cardiac death (SCD).[1] Accordingly, this condition may lead to superior or inferior axis and left bundle branch block (LBBB) ventricular arrhythmias, which have recently been considered as major and minor criteria respectively.[2] On the other hand, idiopathic right ventricular outflow tract (RVOT) arrhythmia occurs with LBBB and inferior axis in the absence of overt structural heart disease and has a more favorable outcome.[3]

Considering several similarities between the two entities (namely LBBB, inferior axis VT, precipitation of symptoms by exercise and presentation predominantly in young otherwise healthy individuals), but with the strict differences in prognoses and therapeutic options, several diagnostic tools are proposed to differentiate between these two.[4–7]

However, despite the task force criteria proposed for distinguishing between these two conditions,[2] there still exists room for new discriminators. Herein we took this challenge to identify such electrocardiographic discriminators between the two entities.

2. Materials & methods

2.1. Study population

Clinical and electrocardiographic data of all consecutive patients admitted in our hospital from 2003 through 2012 and with a diagnosis of either ARVC/D (classified as affected according to 1994 task force[8]) or RVOT VT was collected in a preformed data sheet. Twelve-lead electrocardiogram (ECG) recordings taken with Twelve-channel MAC ECG machine in double voltage 20 mm/1 mv and 25 mm/s speed were analyzed by two specialists unaware of patients' history and clinical diagnosis.

Considering the revision made on ARVC/D definition in 2010,[2] all patients were re-evaluated after data collection and entered in the study only if they were classified as definite ARVC/D (two major or, one major and two minor criteria) cases as per the new definition. Considering that all these patients were labeled as "definite ARVC/D" as per revised definition of the 2010 task force, no change in number of studied patients happened. Patients with LBBB pattern and inferior axis ventricular arrhythmia were grouped in RVOT VT if they did not have any structural abnormality evident in echocardiography or cine-angiography, and nor could they be classified as ARVC/D. Majority of patients were admitted in hospital electively and were clinically stable.

The rational expression behind these new criteria is based on localized fibrosis in right ventricle in ARVC/D patients compared to RVOT VT patients. Thus, we thought that depolarization or repolarization differences may be important. Specific ECG criteria to be compared in the two groups during normal sinus rhythm were:

1) Mean QRS duration in V1–V3
2) S wave upstroke duration from nadir of S to end of QRS
3) Difference in sum of QRS duration in left and right precordial leads: (QRS duration in V1+V2+V3)–(QRS duration in V4+V5+V6)
4) Ratio of sum of QRS duration in right to left precordial leads: (QRS duration in V1+V2+V3)/(QRS duration in V4+V5+V6)
5) JT interval dispersion: JT interval is measured from the beginning of J point to the end of T wave. For each patient, the difference between maximum and minimum JT intervals was calculated as the JT interval dispersion
6) Ratio of sum of JT interval segment in right to left precordial leads: (JT INTERVAL segment in V1+V2+V3)/(JT INTERVAL segment in V4+V5+V6)
7) Presence of T wave inversion in V1 throughV3.

All stages of study were conducted according to Helsinki declaration.

2.2. Data management and statistical analyses

All data was entered and statistical analyses were performed using SPSS version 16 for windows. A univariate analysis was conducted to compare clinical and electrocardiographic variables of patients with ARVC/D and RVOT VT, using student's *T*-test for continuous variable and chi-square test for categorical variables. Using a 2 tailed distribution, a p value ≤ 0.05 was considered significant. For continuous ECG indices, various cut-offs were used and sensitivity and specificity for diagnosing ARVC/D were computed using the 2010 definition of ARVC/D as gold standard.

Based on the computations, we have reported the cut-off that had the highest specificity above 50% and both positive as well as negative predictive values have been reported. Similarly, various cut-offs for ECG indices were used and sensitivity and specificity for diagnosing RVOT VT were computed by considering absence of any structural