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Original Article

Atrial Fibrillation and Beta Thalassemia Major: The Predictive Role of the 12-lead Electrocardiogram Analysis

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Abstract

Background: Paroxysmal atrial tachyarrhythmias frequently occur in beta-thalassemia major (β-TM) patients.The aim of our study was to investigate the role of maximum P-wave duration (P max) and dispersion (PD), calculated trough a new manually performed measurement with the use of computer software from all 12-ECG-leads,as predictors of atrial-fibrillation (AF)in β-TM patients with conserved systolic or diastolic cardiac function during a twelve-months follow-up.

Materials and Methods: 50 β-TM-patients (age38.4±10.1; 38M) and 50-healthy subjects used as controls, matched for age and gender, were studied for the occurrence of atrial arrhythmias during a 1-year follow-up, through ECG-Holter-monitoring performed every three months. The β-TM-patients were divided into two groups according to number and complexity of premature-supraventricular-complexes at the Holter-Monitoring (Group1: <30/h and no repetitive forms, n:35; Group2: >30/h or couplets, or run of supraventricular tachycardia and AF, n:15).

Results: Compared to the healthy control-group, β-TM patients presented increased P-max (107.5± 21.2 vs 92.1±11ms, P=0.03) and PD-values (41.2±13 vs 25.1±5 ms,P=0.03). In the β-TM population, the Group2 showed a statistically significant increase in PD (42.8±8.6 vs 33.2±6.5ms, P<0.001) and P-max (118.1±8.7 vs 103.1±7.5ms, P<0.001) compared to the Group1. Seven β-TM patients who showed paroxysmal AF during this study had significantly increased P-max and PD than the other patients of the Group2. Moreover, P-max (OR:2.01; CI:1.12-3.59; P=0.01) and PD (OR=2.06;CI:1.17-3.64;P=0.01) demonstrated a statistically significant association with the occurrence of paroxysmal AF,P min was not associated with AF-risk (OR=0.99; CI:0.25-3.40; P=0.9) in β-TM-patients. A cut-off value of 111ms for P-max had a sensitivity of 80% and a specificity of 87%, a cut-off value of 35.5ms for PD had a sensitivity of 90% and a specificity of 85% in identifying β-TM patients at risk for AF.

Conclusion: Our results indicate that P-max and PD are useful electrocardiographic markers

for identifying the β-TM-high-risk patients for AF onset, even when the cardiac function is conserved.

Key words: beta-thalassemia major, P-wave dispersion, atrial fibrillation

Introduction

Beta-Thalassemia Major (β-TM) is a hereditary haemoglobin disorder caused by reduced synthesis of β-globin chain and resulting in a chronic haemolytic anaemia. The consequences of chronic anaemia include growth retardation, bone marrow expansion, extramedullary hematopoiesis, splenomegaly, greater intestinal iron absorption, hypercoagulability and higher susceptibility to infections [1]. In the early stage, patients are usually asymptomatic. Restrictive cardiomyopathy usually occurs before dilated cardiomyopathy [2], in accordance with diastolic dysfunction which normally happens before systolic dysfunction and overt heart failure [3-5]. Findings in the early stage are usually incidental, including bradycardia, ST-T changes, infrequent premature atrial or ventricular contractions, first-degree atrioventricular blocks and evidence of left ventricular hypertrophy. In the late stage, frequent premature atrial or ventricular contractions, runs of supraventricular tachycardia, atrial flutter and fibrillation, ventricular tachycardia and second-degree or complete heart blocks have been demonstrated [2,5,6].

QTc and JTc dispersion are useful electrocardiographic markers of sudden cardiac death risk and are increased in some conditions [7-12]. Our previous study suggested that beta thalassemia major is associated with significant changes in heterogeneity of ventricular repolarization, the electrophysiological substrate for ventricular malignant tachyarrhythmias, and the use of QTc dispersion and JTc dispersion, as simple electrocardiographic parameters for stratifying the sudden cardiac death risk in beta thalassemia major patients, should be implemented in our daily clinical practice [13].

The identification of β-TM patients at risk for atrial fibrillation is of pivotal importance for the optimization of the medical therapy to prevent tromboembolic stroke. Maximum P wave duration (P max) and P wave dispersion (PD) are two simple electrocardiographic markers considered to reflect the discontinuous and inhomogeneous propagation of sinus impulses and the prolongation of atrial conduction time [14,15]. PD was shown to be an independent risk factor for development of atrial fibrillation [16,17]. In a previous study [18], we showed a significant increase of P wave dispersion, correlated to myocardial iron deposit, assessed by Cardiac Magnetic Resonance (CMR) T2 imaging, in β-TM patients with conserved systolic and diastolic cardiac function. However, to our knowledge, there are no studies evaluating the predictive value of PD and P max on new onset AF occurrence in β-TM patients.

The aim of the present study was to determine whether maximum P-wave duration and P-wave dispersion detected on surface ECG could predict the new onset paroxysmal atrial fibrillation occurrence in β-TM patients with conserved systolic and diastolic cardiac function.

Materials and Methods

Study population

The study involved 50 β-TM subjects (38 men, 12 women), with a mean age of 38.4 ± 10.1 years and mean body mass index (BMI) of 20.1 ± 3.1 kg/m2. All patients were consecutively recruited from the Internal Medicine of Cardarelli Hospital to participate in the study and followed for a 12 months period. Fifty sex and age-matched non β-TM healthy subjects were also recruited as controls. Inclusion criteria were age between 18 and 50 years. Subjects with a