No association between scar and characteristics on T-wave alternans in post-myocardial infarction patients with relatively preserved ventricular function presented with non-sustained ventricular tachycardia

Sudden cardiac death (SCD) represents a major problem of clinical cardiology. According to statistical data, ca 250-300 thousand individuals die suddenly each year in the USA (1). The leading cause of SCD, responsible for 75-80% of cases, are malignant arrhythmias, including sustained ventricular tachycardia (VT) and ventricular fibrillation (VF). The risk is greatest in patients with history of a VT/VF episode. In patients without history of VT/VF episodes, the most important parameter identifying those at greatest SCD risk is left ventricular ejection fraction (LVEF) below 35-40%. It has been demonstrated, however, that patients with significantly impaired LVEF represent only ca 30% of the total number of SCD cases (2). The evidence to date unequivocally points to the fact that the number of SCD cases in patients with preserved or relatively preserved left ventricular systolic function is very high. Hence, the development of a new research projects that will focus not only on the patients with significant systolic dysfunction, may potentially have a major scientific impact.

Among patients with preserved or relatively preserved left ventricular function, those who present with structural cardiac abnormalities, are of special importance with regard to SCD epidemiology. As reported by Chugh et al. (3), in as much as 95% of patients who died suddenly, morphological abnormalities in the heart were found on autopsy. With this regard, patients with ischemic heart disease represent a group of interest, as in those patients ischemic foci and moreover, post-infarct scarring may represent a potential source of ventricular arrhythmia. To date, risk factors for VT/VF and SCD in those patients have not been sufficiently elucidated.

With regard to VT/VF risk factors in cardiovascular patients, it should be mentioned that the occurrence of ventricular arrhythmia is related to three pathophysiological components: the presence of arrhythmia substrate, triggers and modulators. Different diagnostic modalities may prove useful in the assessment of parameters reflecting each of the three components of the arrythmogenesis. Modalities used for arrhythmia substrate assessment include echocardiography and other imaging techniques (e.g. CMR-cardiac magnetic resonance). Triggering factors include ventricular extrasystole and episodes of non-sustained VT (nsVT) that can be found on Holter ECG recording. Modulators include microvolt T -wave alternans (TWA), as well as a number of parameters reflecting the autonomic system activity.

Echocardiographic study is one of the most accessible diagnostic modalities in cardiology. Apart from prognostic value of LVEF, other echo-derived parameters carrying potential prognostic value for VT/VF and SCD occurrence can be pointed to, such as chamber size with special emphasis on the left ventricle, mass of left ventricle, general or segmental left ventricular hypertrophy and its extent, presence of hypo-, a-, dyskinetic regions. CMR study is a flexible imaging modality that allows assessment of multiple different parameters of cardiac anatomy and function, being a reference method for the latter. Unique features of this imaging modality are related to its ability to provide a reliable insight in tissue composition, including fibro-fatty replacement, oedema, inflammation, infiltration, fibrosis and scar, and integration of these structural findings with regional systolic and diastolic function as well as torsion of the left ventricle (quantitatively assessed with use of tissue tagging CMR technique) can play a role (4). All of these can potentially relate to adverse prognosis (5, 6). Apart from late gadolinium enhancement, which represents a gold standard of scar and viability assessment, a new technique has recently been proposed that allows further insight in the tissue composition, and is based on T1 time maps of the myocardium, that show areas of increased extracellular volume, with some precautions translating to diffuse myocardial fibrosis (7). TWA testing is based on the assessment of repolarization dispersion of cardiomyocytes at rest and during exercise testing. Structural abnormalities in the heart, such as post-infarct scarring may contribute to repolarization inhomogeneity of the myocardium. To date, studies on TWA analysis demonstrate unequivocal relationship between this parameter and malignant arrhythmia occurrence in patients with left ventricular systolic dysfunction (8). There are two methods of TWA analysis: spectral analytic method and time-domain modified moving average (MMA) method. The value of the first is long established, widely documented and has FDA approval. In view of substantial differences in methodology, the results of both methods cannot be regarded as interchangeable.

Data concerning the VT/VF risk factors with regard to patients with preserved and relatively preserved LVEF is limited, chiefly referring to patients with acute myocardial infarction (9, 10). The

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Authors of the article entitled "*No association between scar and characteristics on T-wave alternans in post-myocardial infarction patients with relatively preserved ventricular function presented with non-sustained ventricular tachycardia*" published in this issue of Anatolian Journal of Cardiology tried to investigate important clinical issue concerning the relationship between electrical (TWA analyzed with the use of MMA method) and morphological (ECHO, CMR) results in a group of post-myocardial infarction patients (11). Of note, the link between electrical and morphological parameters of myocardium has been analyzed only in some experimental studies (12, 13) and has not been clarified yet.

In the above mentioned study the Authors have compared two groups: with positive and negative TWA. As the results, these groups did not differ statistically significant in some clinical, ECHO and CMR parameters. The Authors have concluded that there are no association between scar size and characteristics and prevalence of TWA and that both repolarization alternans and scar size by CMR may reflect different arrhythmogenic mechanisms. Of note, TWA can be caused not only morphological, but also functional uni-directional block, which may explain positive alternans results in some patients without evident structural heart disease. On the other hand, areas of myocardial necrosis may lead to alternans amplitude reduction or even nulling, resulting in negative TWA result in some patients with post-infarction scar. Abnormal adrenergic activation in turn can play a role of a major triggering factor for TWA occurrence. Therefore, the results of the study may confirm this explanation.

There are several positive points in this manuscript (11). The aim of the study is very interesting and important from the clinical point of view. The Authors excluded the patients with the history of sustained ventricular tachycardia, in whom clinical decisions are well established. On the other hand, the small sample size can restrict the usefulness of the results. The study group is not representative for all after-myocardial infarction patients, because the only patients with nsVT were included. This study should be marked as a pilot study and needs to be continued on the bigger group to make clinical conclusions.

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