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ORIGINAL ARTICLE

# Radiofrequency catheter ablation of premature ventricular complexes from right ventricular outflow tract in patients with left ventricular dilation and/or dysfunction



Tarek Basiouny \*, Hatem Abd El-Lateif Kholeif,  
Mamdouh Helmy El-Tahan, Mohamed Karim, Wael Attia,  
Mohammed Moanes Mohammed Mohy El-Din

Cardiology Department, Faculty of Medicine, Al-Azhar University, Egypt

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## KEYWORDS

Premature ventricular complexes;  
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**Abstract** Left ventricular (LV) dysfunction caused by frequent premature ventricular complexes (PVCs) can be reversed by suppression of PVCs with antiarrhythmic agents or radiofrequency catheter ablation (RFA). However, there is a paucity of data on the efficacy and safety of RFA among the local population. We aimed in this study to evaluate the effect of RFA of frequent PVCs originating from right ventricular outflow tract (RVOT-PVCs) on cardiac function in patients with depressed cardiac function and/or LV dilation. The study included sixteen patients with monomorphic RVOT-PVCs without overt underlying structural heart disease. Frequency of PVCs by 24-h Holter monitoring, left ventricular ejection fraction (LVEF), end-diastolic diameter (LVEDD), end-systolic diameter (LVESD), mitral regurgitation (MR) by echocardiogram and NYHA functional class were evaluated before and 3 and 6 months after RFA. All patients underwent RFA. **Results:** The higher the number of PVCs/24 h, the bigger the LVESD and the lower the EF. Procedural success was achieved in 13 (81%) of the patients with no complications. Six months follow-up after successful ablation, LVEDD decreased significantly (from  $56.62 \pm 5.87$  to  $49.23 \pm 5.31$  mm;  $p = 0.002$ ), LVESD decreased significantly (from  $41.85 \pm 7.82$  to  $33.69 \pm 4.66$  mm;  $p = 0.002$ ), LVEF increased significantly (from  $46.69 \pm 4.92\%$  to  $60.54 \pm 5.39\%$ ;  $p < 0.001$ ) and NYHA functional class improved in all patients after successful ablation.

\* Corresponding author. Address: 28 Al-mass Alhageb Street, Alhelmeia Algadida, Cairo, Egypt. Tel.: +20 1003284050.

E-mail address: [tareqbasiouny@yahoo.com](mailto:tareqbasiouny@yahoo.com) (T. Basiouny).

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*Conclusion:* RF catheter ablation of frequent RVOT-PVC has a beneficial effect on cardiac function in patients with depressed cardiac function.

It carries a high degree of success and safety. Frequent RVOT-PVCs are burden on LV function even in patients without overt underlying structural heart disease.

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## 1. Introduction

Premature ventricular contractions (PVCs) are early depolarization of the myocardium originating in the ventricle. They are often seen in association with structural heart disease and represent increased risk of sudden death, yet they are ubiquitous, even in the absence of identifiable heart disease.<sup>1,2</sup> They may cause troubling and sometimes incapacitating symptoms such as palpitation, chest pain, presyncope, syncope, and heart failure.<sup>3</sup> Idiopathic ventricular arrhythmias (VA) consist of various subtypes of VA that occur in the absence of clinically apparent structural heart disease. Affected patients account for approximately 10% of all patients referred for evaluation of ventricular tachycardia (VT).<sup>4</sup> Arrhythmias arising from the outflow tract (OT) are the most common subtype of idiopathic VA and more than 70–80% of idiopathic VTs or (PVCs) originate from the right ventricular (RV) OT.<sup>5</sup> Traditionally, PVCs have been thought to be relatively benign in the absence of structural heart disease,<sup>6</sup> but in retrospective analyses premature ventricular complexes have been implicated as a cause of impaired left ventricular function.<sup>2</sup> Also frequent isolated ectopic beats, mostly originating from the right ventricular outflow tract have been reported as a cause of tachycardiomyopathy, a reversible form of congestive heart disease that resolves after elimination of the culprit arrhythmia either by medical treatment or by Radiofrequency Ablation (RFA).<sup>7</sup> Various therapeutic options for ventricular arrhythmias include antiarrhythmic drugs, antiarrhythmic surgery and placement of an implantable cardioverter defibrillator (ICD) for VT, or radiofrequency catheter ablation.<sup>8</sup> When highly symptomatic and refractory to antiarrhythmic therapy or causative for ventricular dysfunction, ablation is a recommended treatment for right ventricular outflow tract PVCs (RVOT-PVCs) with a high success rate and a low risk of complications.<sup>9</sup>

## 2. Aim of the work

This study was undertaken to evaluate the effect of RF ablation of frequent premature ventricular complexes from right ventricular outflow tract (RVOT-PVCs) on cardiac function in patients with depressed cardiac function and to examine whether frequent RVOT-PVCs without overt underlying structural heart disease correlates with LV dilation, which is a well-recognized precursor of LV dysfunction and congestive heart failure or not.

## 3. Patients and methods

The study was conducted at the Cardiology department of our institute from February, 2011 to September, 2013. Patients enrolled in this study when they have symptomatic monomorphic RVOT-PVCs associated with LV dilation (LVEDD  $\geq$  59 mm and/or LVESD  $\geq$  41 mm) and/or impaired LV systolic function

(EF  $\leq$  50%) without overt underlying structural heart disease. RVOT-PVC was defined as a characteristic electrocardiographic appearance of a left bundle branch block (LBBB) contour in V1 and an inferior axis in the frontal plane. We excluded patients with the history of recent myocardial infarction, patients with ECG evidence of myocardial infarction, patients with known coronary stenosis of  $>$  50% diameter, patients with segmental dyskinetic regions by Echocardiography, patients with significant valvular heart disease, patients with congenital heart disease, patients with RV abnormalities, Patients with atrial tachyarrhythmia including AF, atrial flutter, atrial tachycardia, and paroxysmal supraventricular tachycardia and any patient unwilling to have the procedure. LVOT-PVCs diagnosed according to Betensky's algorithm,<sup>10</sup> which utilized the 12-leads surface ECG for PVC localization, were excluded from the study.

All patients signed an informed consent after discussing the procedures and possible alternatives and complications. All patients were subjected to thorough clinical examination, history taking and routine laboratory analysis. Chest radiogram in PA view was done for the measurement of CT ratio and detection of cardiomegaly. Resting 12-Leads surface ECG was performed to detect morphology of PVCs (if frequent) and to exclude evidence of myocardial infarction or evidence of other arrhythmia. Resting Trans-Thoracic Echocardiography (TTE) was undertaken (with the patient lying in the left lateral decubitus using the standard views) on admission, 3 and 6 months after the successful RF ablation. From TTE we can estimate chamber size of LV and right ventricle (RV), Degree of mitral regurgitation (at parasternal long-axis or apical four-chamber view) and Left ventricular ejection fraction (LVEF) which was calculated using the Teichholz method. All values of echocardiogram were recorded during sinus rhythm, but not at the PVC beat, nor at the post-PVC beat. All patients also had routine echocardiogram on the next day of RFA to evaluate the possible procedure related complications. 24-h Holter monitoring was done to all patients before RFA, within 48 h after RFA, 3 and 6 months thereafter and whenever there are significant symptoms during follow up period to exclude recurrence. The %PVC was calculated as: 100-[number of PVC/number of total heart beats per 24 h]. Coronary angiography (CAG) was done for high risk patients to exclude ischemic heart disease, and exercise stress test (ETT) was done for low and intermediate risk patients for the same purpose.

Electrophysiological study, mapping and catheter ablation were done by the conventional method. The patients were studied in the fasting state without sedation. Antiarrhythmic drugs were discontinued for at least six half-lives before the procedure. Under local anesthesia, two 7-F deflectable quadripolar ablation catheters with a 4-mm-tip electrode and 5 mm interelectrode distance were introduced percutaneously into the RV. One of the two catheters was used first to make a land mark for the His position. The ablation catheter was introduced to the RVOT guided by both LAO and RAO

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