Clinical recognition of pure premature ventricular complex-induced cardiomyopathy at presentation

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BACKGROUND Frequent premature ventricular complexes (PVCs) can induce or worsen left ventricular (LV) systolic dysfunction.

OBJECTIVE The purpose of this study was to identify the clinical pattern of patients having a "pure PVC-induced" cardiomyopathy at presentation.

METHODS This prospective multicenter study included 155 consecutive patients (age 55 ± 12 years, 96 men [62%], 23% ±12% mean PVC burden) with LV dysfunction and frequent PVCs submitted for ablation and followed up for at least 12 months. Patients with a previously diagnosed structural heart disease (50 [32%]) and those without complete PVC abolition during follow-up who did not normalize LV ejection fraction (LVEF) (24 [15%]) were excluded from the analysis.

RESULTS Of the remaining 81 patients, 41 (51%) had a successful sustained ablation, did not have normalized LVEF, and were classified as having PVC-worsened nonischemic cardiomyopathy, and 40 (49%) who had normalized LVEF were considered as having pure PVC-induced cardiomyopathy. The latter group had higher baseline PVC burden (27% ± 12% vs 12% ± 8%; $P < .001$), smaller LV end-diastolic diameter (58 ± 5 mm vs 60 ± 6 mm; $P = .05$), and shorter intrinsic QRS (105 ± 12 vs 129 ± 24 ms; $P < .001$). Any of the following baseline characteristics accurately identified patients who will not normalize LVEF after PVC ablation (85% sensitivity, 98% specificity): intrinsic QRS >130 ms, baseline PVC burden <17%, and LV end-diastolic diameter >63 mm.

CONCLUSION Almost half of patients with frequent PVCs and low LVEF of unknown origin normalize LVEF after sustained PVC abolition, and these patients can be identified before ablation.

KEYWORDS Ablation; Induced cardiomyopathy; Left ventricular dysfunction; Premature ventricular complex; Structural heart disease

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Introduction

Ablation of frequent premature ventricular complexes (PVCs) improves left ventricular ejection fraction (LVEF) in patients with left ventricular (LV) systolic dysfunction.[1–5] The benefit of PVC suppression was originally described in patients with suspected PVC-induced cardiomyopathy (CM). In the initial studies, most patients normalized LVEF if PVC ablation was successful.[2–4] However, frequent PVCs can also worsen LV function in patients with previous structural heart disease (SHD), as shown in patients with ischemic heart disease or in those who did not respond to cardiac resynchronization therapy.[6–8] It has been also observed that a subgroup of patients without previously diagnosed SHD did not normalize LVEF despite successful sustained ablation (SSA) during follow-up and should be considered as having nonischemic cardiomyopathy (NICM) worsened by the high PVC burden.[9]

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However, no clinical, ECG, Holter, or echocardiographic characteristics differentiated patients having a "pure PVC-induced" CM from those with NICM worsened by the high PVC burden. Currently, diagnosis of pure PVC-induced CM can only be made during follow-up, after documentation of complete LVEF recovery, whereas NICM of any origin plays a role in patients not normalizing LVEF despite sustained PVC abolition and can contribute to a worse prognosis.

The aim of the present study was to identify distinctive characteristics of patients having a "pure PVC-induced" CM that identify this clinical entity at presentation, before information is given to the patient and treatment is established, in an unselected population of consecutive patients with high PVC burden and LV systolic dysfunction.

Methods

We report the results of a predefined secondary endpoint of a multicenter prospective study. From February 2010 to October 2015, consecutive patients with frequent PVCs and LV systolic dysfunction (LVEF <50%) were included from 5 centers. Frequent PVCs was defined as a burden >4% at baseline 24-hour Holter monitoring, which is the lowest PVC burden associated with LV dysfunction in the literature.[10] Patients with mitral and aortic metallic prosthesis and PVC with a supposed LV origin were excluded. No patient was excluded because of the number of PVC morphologies or the presumed site of origin based on ECG criteria. The entire population had received optimal medical therapy for heart failure at the maximum tolerated dose for at least 3 months at the time of study inclusion (Table 1). The local ethics committee of each participating center approved the study, and all participants provided written informed consent.

Baseline evaluation

A detailed medical history consisting of drug therapies, clinical evaluation, and basal blood test including brain natriuretic peptide (BNP) levels were obtained for all participants. In all patients without previously diagnosed SHD, ischemic heart disease was ruled out by coronary angiography or noninvasive stress test before the ablation procedure. A 12-lead surface ECG and 24-hour Holter monitoring were obtained in all patients to evaluate the presence of multiple morphologies and to calculate the PVC burden. Baseline echocardiography was performed within 3 months before the procedure. LVEF was calculated by the Simpson formula, computing 3 consecutive averaged beats to minimize distortion generated by PVC. The echocardiographic evaluation did not include ectopic or postectopic cycles.

Ablation procedure

Before the ablation, antiarrhythmic drugs except amiodarone were withdrawn for 5 half-lives. Ablation was guided by the CARTO navigation system (Biosense Webster, Waterloo, Belgium) using a 3.5-mm irrigated-tip catheter (Navi-Star or Smart Touch, Biosense Webster) for mapping and ablation. Acute successful ablation was considered when targeted PVC was eliminated. Patients were monitored for 20 minutes after the procedure to ensure complete PVC abolition. If present, antiarrhythmic drugs were discontinued in case of acute successful ablation. As the entire population of the study had LV dysfunction, therapy with beta-blockers was maintained, independent of ablation success.

Follow-up and definitions

Patients were followed up at the outpatient clinic at 6 and 12 months and annually thereafter. Echocardiography was

Table 1 Baseline characteristics

	Pure PVC-induced CM (n = 40)	PVC-worsened CM (n = 41)	Total (n = 81)	*P* value
Age (years)	51 ± 14	51 ± 10	51 ± 12	.9
Sex (male)	18 (45%)	21 (51%)	39 (48%)	.7
LVEF (%)	35 ± 8	33 ± 7	34 ± 7	.29
LVESD (mm)	43 ± 6	47 ± 8	45 ± 7	.04
LVEDD (mm)	58 ± 5	60 ± 6	59 ± 6	.05
NYHA functional class	2 ± 0.7	1.9 ± 0.4	1.95 ± 0.6	.46
QRS duration (ms)	105 ± 12	129 ± 24	119 ± 23	<.001
Beta-blocker therapy	37 (93%)	39 (95%)	76 (94%)	.67
ACE inhibitor therapy	32 (80%)	39 (95%)	71 (87%)	.05
PVC-QRS duration	162 ± 19	174 ± 20	168 ± 20	.012
Conduction disorder				
LBBB	3 (7%)	7 (17%)	10 (12%)	.03
RBBB	0	9 (22%)	9 (11%)	
HB	1 (2%)	2 (5%)	3 (4%)	
Unspecific	0	1 (2%)	1 (1%)	
CMR scar (n = 66)	1 (4%)	3 (9%)	4 (6%)	.2
PVC Holter (%)	27 ± 118	12 ± 8	19 ± 11	<.001
>1 PVC morphology	10 (25%)	3 (7%)	13 (16%)	.037
BNP (pg/mL)	171 ± 296	115 ± 265	144 ± 280	.47

ACE = angiotensin-converting enzyme; BNP = brain natriuretic peptide; CM = cardiomyopathy; CMR = cardiac magnetic resonance; HB = hemiblock; LBBB = left bundle branch block; LVEDD = left ventricular end-diastolic diameter; LVEF = left ventricular ejection fraction; LVESD = left ventricular end-systolic diameter; NYHA = New York Heart Association; PVC = premature ventricular complex; RBBB = right bundle branch block.