LETTER TO THE EDITOR

Response to Dr. Madias' comments on "T-Wave Alternans by a 16-Lead Electrocardiogram System"

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To the Editor

We appreciate the interest for our recent article published in the *Journal*¹ on April 17, 2012, and for the stimulating questions that have been raised by Dr. Madias.

Our clinical data consisted of ECG recordings from 58 patients with an implanted cardiac defibrillator. Twenty-nine of these patients developed ventricular arrhythmias or ventricular fibrillation during the follow-up and were classified as "cases." The other 29 patients were classified as "controls." All patients were receiving standard care and underwent a bicycle ergometer test during which an 8-lead (I, II, V₁ to V₆) ECG recording was obtained (GE CASE 8000 recorder). Lead III, aVR, aVL and aVF were obtained using simple geometric considerations on the Einthoven's triangle, whereas leads X,Y and Z were obtained using the inverse Dower's transform. Eventually the vector magnitude, VM, was computed according to its definition. All the involved equations and transformations are well-known and largely used in clinics, so we felt allowed to use them, especially because many commercial ECG recorders (like ours) provide a reduced number of leads. Nevertheless, we agree with Dr. Madias when he states that direct recording of 15-lead ECGs would have been preferable, and are willingness to evaluate the association between T-wave alternans (TWA) and T-wave amplitude (TA) again incollaboration with

Table 1. Analysis of the Inpatient TWA Dependency on TA

	Cases		Controls	
	ρ	P	ρ	P
1	0.54	<0.05	0.41	NS
2	0.84	<0.001	0.88	<0.001
3	0.03	NS	0.54	<0.05
4	0.82	<0.001	0.70	<0.01
5	0.44	NS	0.57	<0.05
6	0.86	<0.001	0.62	<0.05
7	0.14	NS	−0.18	NS
8	0.70	<0.05	0.62	<0.05
9	0.23	NS	0.70	<0.01
10	0.87	<0.001	0.63	<0.01
11	0.31	NS	0.38	NS
12	0.12	NS	0.21	NS
13	0.90	<0.001	−0.31	NS
14	0.40	NS	0.92	<0.001
15	0.87	<0.001	0.54	<0.05
16	0.85	<0.001	0.61	<0.05
17	0.86	<0.001	0.64	<0.01
18	0.21	NS	0.66	<0.01
19	0.91	<0.001	0.18	NS
20	−0.05	NS	0.15	NS
21	0.69	<0.01	0.59	<0.05
22	0.81	<0.001	0.45	NS
23	0.12	NS	0.85	<0.001
24	0.55	<0.05	0.87	<0.001
25	0.60	<0.05	0.77	<0.001
26	0.86	<0.001	0.78	<0.001
27	0.10	NS	0.25	NS
28	0.50	<0.05	0.42	NS
29	0.67	<0.01	0.72	<0.01

Note: For each case and control patient, a value of a correlation, computed on the 16-measures of TWA and TA for each lead, is reported.

NS: Not statistically significant.

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someone who could provide us with such kind of data.

In addition to that, Dr. Madias also suggests to investigate the dependency of TWA on TA by performing an new inpatient analysis consisting of 16-measurements TWA/TA correlations, corresponding to the 16-lead ECGs obtained in each patients, for all our cases and controls. The results of such analysis is reported in Table 1. Globally, the correlation (ρ) was low ($|\rho| < 0.50$) or not statistically significant in 21 (36.2%) patients,

medium ($0.50 \leq \rho \leq 0.75$) in 20 (34.5%) patients, and high ($\rho > 0.75$) in 17 (29.3%) patients. Thus, the inpatient a TWA-TA association evaluated here is strongly patient dependent in our population of ICD patients.

REFERENCES

1. Burattini L, Man S, Burattini R, Swenne CA. Comparison of standard versus orthogonal ECG leads for T-wave alternans identification. *Ann Noninvasive Electrocardiol.* 2012;17:130-140.