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AUTHORS' CONTRIBUTION

All authors have contributed substantially to the drafting, review, and intellectual content of the manuscript.

CONFLICTS OF INTEREST

None declared.

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New research avenues for the prognostic value of the Tpeak-Tend interval in patients with different morphological variants of tako-tsubo syndrome



Nuevas vías de investigación para el valor pronóstico del intervalo onda Tpeak-Tend en pacientes con diferentes variantes morfológicas del síndrome de tako-tsubo

To the Editor,

I was delighted to read the interesting study by Rosa et al.,¹ in which the authors evaluated the prognostic value of the corrected global (mean of the 12-lead electrocardiogram [ECG] values) Tpeak-Tend interval (Tpeak-Tend) at 48 hours from admission in 87 consecutive patients, aged 72 ± 12 years, with tako-tsubo syndrome (TTS). The authors found that a Tpeak-Tend of > 108 ms was an independent predictor of subacute (beyond 48 hours after admission) ventricular arrhythmias (VAs), defined as premature ventricular contractions ≥ 2000 within a 24-hour window of telemetry monitoring, ventricular fibrillation, sustained ventricular tachycardia (VT), polymorphic VT, and nonsustained VT. Such VAs, detected during a median of 8 days of hospitalization, were found to be associated with greater in-hospital mortality. The predictive performance of Tpeak-Tend was found to be superior to that of the standard corrected QT interval (QTc), currently used in patients monitored after TTS.¹ The authors emphasize the advantages of employing all 12 ECG leads, rather than the limb or the precordial leads, in calculating the Tpeak-Tend; they also allude to the hypothesis that myocardial edema (ME) may be at the root of the repolarization aberrations and subacute VAs, via a re-entry or afterdepolarization mechanism due to delayed and dispersed ventricular apico-basal, interventricular and transmural repolariza-

tion gradients,¹ as previously proposed.^{2–4} Unfortunately, cardiac magnetic resonance data to evaluate ME were available in only 21% of their patients, and thus the authors could not evaluate the relationship of repolarization aberrations (Tpeak-Tend and QTc) and VAs with the inflammatory ME.¹

I would appreciate the authors' response to the following points: *a*) the calculation of T-peak-Tend is labor-intensive; perhaps the global Tpeak-Tend can be electronically calculated, since many other ECG calculations (eg, QT) are currently automatically available upon ECG recording in many commercially available contemporary electrocardiographs; *b*) to evaluate the feasibility of such an undertaking, perhaps the authors could compare their QTc values, as manually measured, with those calculated by their ECG recording equipment (EL 280 Resting Electrocardiograph, Welch Allyn, United States), as has been done previously; *c*) although the authors carried out an impressively comprehensive analysis, using a very large array of variables,¹ there is no information on the different morphological variants (ie, apical, mid-ventricular, basal/inverse, or focal) encountered in their 87 patients with TTS; *d*) the topography of ME would most probably be expected to differ in intensity in the apical and the basal/inverse TTS morphological phenotypes; indeed, in mid-ventricular TTS, it has been found to be more intense in the mid-lateral wall, with corresponding T-wave inversion/QTc prolongation confined to the lateral ECG leads³; *e*) accordingly, it would be of interest for the authors¹ to explore whether the global Tpeak-Tend and QTc differed in patients with apical vs basal/inverse TTS; *f*) of even greater interest is the question of whether the Tpeak-Tend and QTc, derived from limb, or precordial, or individual (eg, lateral)³ ECG leads, were more prolonged in patients with apical, basal/inverse, or mid-ventricular TTS.

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New research avenues for the prognostic value of the Tpeak-Tend interval in patients with different morphological variants of tako-tsubo syndrome. Response



Nuevas vías de investigación para el valor pronóstico del intervalo onda Tpeak-Tend en pacientes con diferentes variantes morfológicas del síndrome de tako-tsubo. Respuesta

We are very grateful to have received Prof Madias's comments on our article,¹ as his observations are extremely pertinent and of great clinical significance.

Regarding the automatic calculation of the Tpeak-Tend interval, we are developing an algorithm that might enable us to obtain a readily available measurement in normal electrocardiographs (ECG), like those for QTc. The technical challenge lies in the interpretation of the variability of the T wave patterns, especially in suboptimal ECG recordings. However, following Prof Madias's suggestion, we found a good correlation between our QT and QTc measurements on admission and at 48 hours and the values provided by our ECG recording machine (EL 280 Resting Electrocardiograph, Welch Allyn, United States). Indeed, the intraclass correlation coefficient values were between 0.821 and 0.876, thus showing the specific possibility of pursuing this issue successfully.

Regarding the other important point on the analysis of the distinct *tako-tsubo* variants with respect to ECG repolarization parameters, in our population, we have detected 66 patients with the apical form, 1 with the inverse form, 16 with the mid-ventricular form, and 2 with the focal form, as indicated in table 4 of the supplementary data¹. According to Prof Madias's suggestion, we have evaluated ECG repolarization parameters among the 4 variants on admission and at 48 hours, including both the different electrocardiographic configurations described in the paper ("global", "precordial" and "in limb leads") and individual values. We found no statistically significant differences among the 4 groups. However, when we compared the apical and mid-ventricular variants only (the most conspicuous in terms of patient

numbers), we found a trend toward higher values of the corrected global Tpeak-Tend in the apical variant group at 48 hours (113 ± 29 ms vs 105 ± 23 ms; $P = .370$). The latter was driven by the corrected precordial Tpeak-Tend (119 ± 28 ms vs 102 ± 19 ms; $P = .112$). Conversely, the corrected Tpeak-Tend in limb leads showed no relevant differences between apical and mid-ventricular variants (105 ± 35 ms vs 105 ± 34 ms; $P = .991$). We also evaluated each lead individually at 48 hours, without finding any statistically significant differences between the 2 groups.

These results were probably influenced by the small sample size of the groups and should also be complemented by cardiac magnetic resonance at 48 hours. All together, this would allow effective evaluation of the relationship among regional variants, edema and repolarization dispersion.

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AUTHORS' CONTRIBUTIONS

G. La Rosa and G. Pelargonio drafted the article. ML. Narducci, and F. Crea revised the article critically for important intellectual content. All authors approved the final version.

CONFLICTS OF INTEREST

None.

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