Ultradian diurnal variations of QTc and relevant cardiovascular characteristics should be considered with regard to risk assessment

The importance of QT prolongation in arrhythmia was discussed in several excellent papers in the Supplement to a September issue of the Journal\[1\].

Circadian variations in ECG intervals and ECG wave amplitudes have been known for many years\[2–8\]. Diurnal variations in ECG characteristics may be substantially influenced by the intrinsic rhythmic activity of myocardial cells and periodic external factors such as plasma catecholamines, serum electrolytes and sympathetic or parasympathetic tone\[3,9\]. In most of the studies, QT intervals were shorter during the night and decreased during the day with minimum values in the afternoon. Oxygen consumption, often estimated by means of the double product, increases in the morning hours\[10\]. The increase in tachyarrhythmias during the morning hours may be the concerted result of cardiovascular, endocrinological and haemostatic alterations\[11\].

In addition circadian variations ultradian rhythms (period <24 h), with regard to ECG characteristics, could probably influence the risk of arrhythmia. We have fitted population data from clinical studies to a standard cosinor model \( Y(t) = \text{MESOR} + A\cos(2\pi t/T + \phi) \)\[12\]. The MESOR (Midline Estimating Statistic of Rhythm, MESOR) corresponds to the value midway between the extreme values of the cosine curve. \( A \) denotes the amplitude of the model, \( T \) denotes the duration of a period and \( \phi \) the acrophase (maximum) with regard to a time reference (e.g. 08.00h) of the fitted curve. (Due to population data with different intervals \( M \) is not exactly identical to the arithmetic mean). The goodness of fit was assessed by means of the F-statistic and 95% prediction limits are given.

Figures 1 and 2 show the results of the QTc values and double products. The findings confirm a periodicity of approximately 6 h, which is a harmonic of the basic circadian rhythm. In order to understand the pathophysiology, on the one hand, and to adjust suited treatments on the other it may be advantageous to consider underlying diurnal variations of arrhythmias. Such mechanisms may be responsible for both changes of heart rate variability in patients and the circadian distribution of heart attacks with lethal outcome\[13,14\].

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References


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