QT dispersion and heart rate variability

See page 258 for the article to which this Editorial refers

Changes in autonomic nervous system control are often found in patients with left ventricular dysfunction and heart failure[1]. Heart rate variability and ventricular repolarization characteristics are parameters modulated by the autonomic nervous system and they may provide a non-invasive tool for obtaining reliable and reproducible information on the autonomic nervous system for the purpose of risk stratification in patients with congestive heart failure.

There is strong evidence that non-uniform recovery of excitability may be essential in triggering malignant ventricular arrhythmias. A surface ECG is useful in clinical practice for studying the heterogeneity of ventricular repolarization, and the QT interval, which encompasses ventricular depolarization and repolarization, is used to measure the duration of ventricular repolarization. Changes in the repolarization wave (T wave) are also important.

The heterogeneity of repolarization may be both spatial and dynamic[2]. Spatial heterogeneity is defined as the dispersion of repolarization durations in simultaneously recorded leads (QT dispersion). The importance of QT dispersion as a marker of arrhythmic risk in different clinical settings, including chronic heart failure[3], has been confirmed since the pioneering paper by Day et al.[4]. As QRS duration may contribute to arrhythmic risk, measurement of the dispersion of the JT interval, which truly represents ventricular repolarization, has been considered a better predictor of cardiac death[5]. This has led to questioning the predictive value of QT dispersion as a marker of poor outcome.

Dynamic changes in the repolarization pattern (duration and morphology) have also been considered predictors of risk. Peaks of QTc >500 ms are detected on Holter tapes more frequently in post-myocardial infarction patients with ventricular tachycardia during follow-up than in post-myocardial infarction patients without arrhythmic events[6]. Thus QTc peaks also appear to be a marker of poor outcome after myocardial infarction. Using new techniques, mild changes in the morphology of repolarization waves detected on surface ECGs have been reported to be markers of poor prognosis[7]. In some patients, particularly with the long QT syndrome and in the presence of important acute ischaemia, QT dispersion and beat-to-beat changes in the morphology of repolarization may be observed[2]. However, manual measurement of QT dispersion and particularly of dynamic QT changes on Holter tapes[6] is a time-consuming process. This drawback may be overcome by using algorithms to measure automatically the QT interval and T waves[8]. The use of digitized 12-lead ECGs, may, in the near future, allow computer analysis of QT dispersion, much as QRS and QT duration are now analysed automatically on many new ECG recorders[2,7].

Early heart rate variability studies, focussing on myocardial infarction patients, found that decreased heart rate variability correlated with poor prognosis[11]. Later, in other studies various authors demonstrated that patients with congestive heart failure had decreased heart rate variability that seemed to be independent of aetiology and the presence of ventricular arrhythmias. However, there have been conflicting results using heart rate variability to stratify risk in patients with congestive heart failure, with some papers reporting a positive relationship and others no[11,9].

Thus the role of autonomic nervous system disturbances in sudden death is currently evolving. It seems clear that different parameters related to autonomic modulation of heart rate and ventricular repolarization (QT dispersion and dynamic changes in repolarization — QT interval and T wave morphology) may play an important role in risk stratification for different disorders (long QT syndrome, post-infarction patients, etc.) but their value is not completely clear in patients with congestive heart failure.

With this in mind, the group from St. George's Hospital, who have already made pioneering contributions to this field, carried out the study published in this issue[10]. From a methodological point of view, it is important to emphasize that both QT dispersion and heart rate variability were evaluated on standard 12-lead ECGs. This has potentially important implications for clinical practice because it avoids using
data derived from 24-h Holter recordings, which requires laborious manual editing or complex and never perfect, computing software. Given the fact that correction of the QT interval for heart rate may be misleading, the QT interval was not corrected for heart rate in this study. An important limitation of using heart rate variability and QT parameters to stratify risk in patients with advanced heart disease is that patients with arrhythmias (such as atrial fibrillation) or bundle branch block are not eligible. In the paper by Fei et al., 55% of patients were excluded for these reasons. Obviously this biases the conclusions and certainly limits the value of the results.

Fei et al. showed that reduced RR variation on standard 12-lead ECGs had important prognostic implications in patients with congestive heart failure secondary to idiopathic dilated cardiomyopathy. In contrast, there were no significant differences in QT dispersion between survivors and patients who died or received transplants during follow-up.

Further studies are warranted to validate the role of heart rate variability detected on surface ECGs in other populations, such as patients with post-myocardial infarction or other heart diseases. Furthermore, heart rate variability measured on standard 12-lead ECGs should be compared with heart rate variability results obtained on Holter tapes using different techniques. The St George group recently published a paper analysing heart rate variability on long-term Holter recordings in which they concluded that the condition did not help to identify patients with congestive heart failure at risk of sudden death.

The other important conclusion of the Fei et al. paper is that QT dispersion, at least as evaluated with this methodology, did not predict death in the group of patients with congestive heart failure, considered eligible for the study. This finding contrasts with the results of the study by Barr et al.

In the evolving field of the use of heart rate variability and QT parameters for risk stratification in patients with congestive heart failure, it is important to consider the following: (1) an important limitation is that many patients (more than 50% in the Fei group) are ineligible, (2) heart rate variability can be measured on surface ECGs, and (3) heart rate variability parameters were more predictive of prognosis than QT dispersion, at least as assessed with the Fei et al. methodology in patients with idiopathic congestive heart failure. (4) It is necessary to clarify the different results obtained by Holter and surface ECG regarding the role of HRV to stratify risk of sudden death in patients with congestive heart failure.

We consider that further studies comparing heart rate variability measurements on 12-lead ECGs and Holter tapes, spatial (QT dispersion) and dynamic heterogeneity of repolarization and new techniques that permit the inclusion of more patients in the studies are needed to establish the real value of these parameters in stratifying risk in patients with congestive heart failure and other cardiac diseases.

A. BAYÉS DE LUNA
X. VINOLAS
Hospital Sant Pau, Barcelona, Spain

References


Eur Heart J, Vol. 17, February 1996