European Heart Journal (1996) **17**, 354–381

Guidelines

Heart rate variability

Standards of measurement, physiological interpretation, and clinical use

Task Force of The European Society of Cardiology and The North American Society of Pacing and Electrophysiology (Membership of the Task Force listed in the Appendix)

Introduction

The last two decades have witnessed the recognition of a significant relationship between the autonomic nervous system and cardiovascular mortality, including sudden cardiac death[1–4]. Experimental evidence for an association between a propensity for lethal arrhythmias and signs of either increased sympathetic or reduced vagal activity has encouraged the development of quantitative markers of autonomic activity.

Heart rate variability (HRV) represents one of the most promising such markers. The apparently easy derivation of this measure has popularized its use. As many commercial devices now provide automated measurement of HRV, the cardiologist has been provided with a seemingly simple tool for both research and clinical studies[5]. However, the significance and meaning of the many different measures of HRV are more complex than generally appreciated and there is a potential for incorrect conclusions and for excessive or unfounded extrapolations.

Recognition of these problems led the European Society of Cardiology and the North American Society of Pacing and Electrophysiology to constitute a Task Force charged with the responsibility of developing appropriate standards. The specific goals of this Task Force were to: standardize nomenclature and develop definitions of terms; specify standard methods of measurement; define physiological and pathophysiological correlates; describe currently appropriate clinical applications, and identify areas for future research.

In order to achieve these goals, the members of the Task Force were drawn from the fields of mathematics, engineering, physiology, and clinical medicine. The standards and proposals offered in this text should not limit further development but, rather, should allow appropriate comparisons, promote circumspect interpretations, and lead to further progress in the field.

The phenomenon that is the focus of this report is the oscillation in the interval between consecutive heart beats as well as the oscillations between consecutive instantaneous heart rates. 'Heart Rate Variability' has become the conventionally accepted term to describe variations of both instantaneous heart rate and RR intervals. In order to describe oscillation in consecutive cardiac cycles, other terms have been used in the literature, for example cycle length variability, heart period variability, RR variability and RR interval tachogram, and they more appropriately emphasize the fact that it is the interval between consecutive beats that is being analysed rather than the heart rate per se. However, these terms have not gained as wide acceptance as HRV, thus we will use the term HRV in this document.

Background

The clinical relevance of heart rate variability was first appreciated in 1965 when Hon and Lee[6] noted that fetal distress was preceded by alterations in interbeat intervals before any appreciable change occurred in the heart rate itself. Twenty years ago, Sayers and others focused attention on the existence of physiological rhythms imbedded in the beat-to-beat heart rate signal[7–10].

Key Words: Heart rate, electrocardiography, computers, autonomic nervous system, risk factors.

The Task Force was established by the Board of the European Society of Cardiology and co-sponsored by the North American Society of Pacing and Electrophysiology. It was organised jointly by the Working Groups on Arrhythmias and on Computers of Cardiology of the European Society of Cardiology. After exchanges of written views on the subject, the main meeting of a writing core of the Task Force took place on May 8–10, 1994, on Necker Island. Following external reviews, the text of this report was approved by the Board of the European Society of Cardiology on August 19, 1995, and by the Board of the North American Society of Pacing and Electrophysiology on October 3, 1995.

Published simultaneously in *Circulation*.

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0195-668X/96/030354+28 $18.00/0

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