

Neural Mechanisms in Cardiac Arrhythmias

Perspectives in Cardiovascular Research Volume 2

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Preface

In the past few years it has become increasingly evident that the nervous system is a primary factor in the genesis of lethal arrhythmias whether or not they are associated with acute myocardial ischemia. However, the mechanism whereby the nervous system exerts its actions is unknown and the methods of treating this component remain empirical. The significance of the problem lies in the overwhelming importance of cardiac arrhythmias as a cause of death.

The problem involves both practical considerations of therapy for the physician and hypotheses about control of the heart's function for the experimental scientist. In fact this is one setting in which the physician has the opportunity to act also as an experimental scientist. The problem is extremely complex and the most rewarding approach initially seems likely to be a multidisciplinary attack. The present volume contains reviews by outstanding clinicians and researchers working in the areas of clinical cardiology, cardiac electrophysiology, cardiac pharmacology, and neurocirculatory control. In order to explore questions of fundamental significance with regard to the neural mechanisms involved in the genesis of cardiac arrhythmias, a variety of innovative techniques have been developed, ranging from experiments on isolated cardiac cells to studies in conscious animals, from penetrating clinical observations to controlled clinical trials. This volume does not solve the problem of neural involvement in arrhythmias; rather it focuses attention upon the problem, outlines its current status, and suggests new lines of research.

The first section of this volume is devoted to the definition and discussion of the clinical problem. This is followed by an analysis of the roles played by the vagal and sympathetic cardiac nerves in the genesis of arrhythmias, a review of cardiac and baroreceptor reflexes and their participation in the control of cardiac rhythm, cardiac autonomic pharmacology, and ongoing studies on various aspects of neural involvement in cardiac arrhythmias.

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CARDIAC ARRHYTHMIAS: THE CLINICAL PROBLEM

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Some Aspects of Sudden Cardiac Death

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Among the many noncoronary conditions precipitating abrupt cardiac death are dysrhythmias or conduction blocks in idiopathic scarring of the conduction system and in sinus node dysfunction, in acquired and congenital valvular lesions and other malformations, in hypertrophic obstructive and other cardiomyopathies, in Wolff-Parkinson-White syndrome, in mitral valve prolapse, in metabolic and electrolyte disturbances, in cardiac sensitivity to drugs such as quinidine, digitalis, phenothiazines, and amitriptyline, and in the long QT syndrome. The last is the most provocative example of neurally mediated, noncoronary sudden cardiac death. Episodes of ventricular fibrillation in individuals with the long QT syndrome often occur with emotional or physical stress. A congenital imbalance in cardiac sympathetic innervation has been postulated as the pathogenetic mechanism (25). The two most successful ways to prevent ventricular fibrillation in this disorder are treatment with β -adrenergic blocking agents and surgical interruption of the left sympathetic pathways to the heart (25,26; Schwartz and Stone, *this volume*).

Coronary disease is the principal cause of death in the Western world, and the majority of afflicted patients die suddenly outside the hospital from cardiac arrest. Two points are paramount in sudden coronary death. First, death is almost always due to ventricular fibrillation. Second, acute or chronic myocardial ischemia seems responsible for initiating the sequence of events that leads to ventricular fibrillation. Myocardial ischemia creates biochemical, metabolic, and hormonal disturbances that result in electrophysiologic and hemodynamic aberrations (5,28). Although many of these pathophysiologic responses to ischemia may be viewed as not neural, the link with deranged autonomic activity is strong. Sympathetic overactivity early in acute myocardial infarction is a well-defined clinical syndrome that may lead directly to ventricular fibrillation as it enlarges the threatened myocardium (21). If vagal overactivity produces bradycardia, the attendant temporal dispersion of the refractory periods of injured and normal ventricular myocardial cells (13) exposes the heart to greater danger from ectopic beats (11), particularly if sympathetic activity increases suddenly (12).