Contents

Foreword: Deviant Behavior xv
Bimal H. Ashar

Preface: Electricity 101: Simplifying the World of Rhythms and Devices xvii
Otto Costantini

Basic Principles of Cardiac Electrophysiology 767
Otto Costantini

This article represents an overview of the basic concepts of cardiac electrophysiology. This relatively new field became a subspecialty of cardiology in the mid-1990s due to the rapid development of equipment that allowed the study and cure of cardiac arrhythmias percutaneously. Simultaneously, technology provided the field with percutaneous cardiac implantable electronic devices designed to protect patients from life-threatening bradyarrhythmias and tachyarrhythmias. Recently, the field has focused on the ablative treatment of atrial fibrillation, the most common arrhythmia facing an aging population, and the diagnosis and management of many inherited arrhythmias through advances in understanding of their genetic cause.

The Electrocardiogram: Still a Useful Tool in the Primary Care Office 775
John Hornick and Otto Costantini

A 12-lead electrocardiogram (ECG) is the most commonly ordered cardiac test. Although data are not robust, guidelines recommend against performing an ECG in patients who are asymptomatic, even if they have a higher risk of developing cardiovascular disease in the long term. Conversely, patients with cardiac symptoms, including chest pain, dyspnea, palpitation, and syncope, should have an ECG performed in the office. Computerized algorithms exist ubiquitously to guide interpretation, but they can be the source of erroneous information. A stepwise approach is given to guide the primary care physician’s approach to the systematic interpretation of ECG tracings.

Palpitation: Extended Electrocardiogram Monitoring: Which Tests to Use and When 785
Kara J. Quan

Palpitation is common. It is often accompanied by dizziness, lightheadedness, near syncope, and even syncope. It may be difficult to confirm a diagnosis in patients with infrequent symptoms. Several tools are available to document arrhythmias in the workup of a patient with palpitation, including 24-hour Holter monitoring, 30-day external continuous monitoring, and implantable loop recorders. A number of private companies are now able to empower patients to monitor heart rates and
When Is Syncope Arrhythmic? 793
Evan Martow and Roopinder Sandhu
Cardiac arrhythmia is a common cause of syncope. The prompt identification of arrhythmic syncope has diagnostic and prognostic implications. In this article, an approach to identifying and managing arrhythmic syncope is discussed, including key findings from the history, physical examination, electrocardiogram, role of risk stratification, use of supplemental investigations, and treatment.

Inherited Cardiac Arrhythmias and Channelopathies 809
Jessica Kline and Otto Costantini
With recent advances in genetic diagnostics, many inherited diseases, which can cause life-threatening arrhythmias, are being better characterized. Many of these diseases are caused by genetic disorders that affect the function of the ion channels that regulate the action potential or the function of important cardiac muscle regulatory proteins. This article summarizes the diseases that we have learned about, such as the long QT syndrome, Brugada syndrome, and catecholaminergic polymorphic ventricular tachycardia. The article examines the diagnosis, genetic screening of patients and their relatives, management, and referral to a specialist for further therapy.

Antiarrhythmic Drugs: Risks and Benefits 821
Pranav Mankad and Gautham Kalahasty
The narrow therapeutic window of antiarrhythmic drugs makes their use clinically challenging. A solid understanding of the mechanisms of arrhythmias and how antiarrhythmics affect these mechanisms is only a preliminary step in their appropriate selection. Clinical factors, side-effect profiles, and proarrhythmic risks are more important than the cellular mechanisms of actions in drug selection and monitoring. This article provides a simplified approach to understanding cellular mechanisms and provides a practical approach to the selection and use of this important class of medications.

Pharmacologic and Nonpharmacologic Management of Atrial Fibrillation 835
Vishal Dahya and Tyler L. Taigen
Atrial fibrillation (AF) is the most common arrhythmia and its management may be organized into risk stratification and/or treatment of heart failure, stroke prevention, and symptom control. At the core of symptom control, treatment is tailored to either allow AF continue with controlled heart rates, so-called rate control, versus restoring and maintaining sinus rhythm or rhythm control. Rate control strategies mainly use rate-modulating medications, whereas rhythm control treatment includes therapy aimed at restoring sinus rhythm, including pharmacologic and direct current
cardioversion, as well as maintenance of sinus rhythm, including antiarhythmic medications and ablation therapy.

**Stroke Prevention in Atrial Fibrillation: The Role of Oral Anticoagulation**

Viwe Mtwesi and Guy Amit

Oral anticoagulation significantly reduces the risk of stroke in patients with atrial fibrillation (AF), and the decision to initiate therapy is based on assessing the patient’s yearly risk of stroke. Although warfarin remains the drug of choice in patients with AF and artificial mechanical valves, the novel anticoagulation agents are becoming the drug of choice for all other patients with AF, because of their efficacy, safety, and ease of use. This article summarizes the current evidence for stroke prevention in AF, including valvular AF, subclinical AF, AF in patients with renal insufficiency, as well as stroke prevention around AF cardioversion.

**Supraventricular Tachycardia**

Arun Umesh Mahtani and Devi Gopinath Nair

The term paroxysmal supraventricular tachycardia encompasses a heterogeneous group of arrhythmias with different electrophysiologic characteristics. Knowledge of the mechanism of each supraventricular tachycardia is important in determining management in the office, at the bedside, and in the electrophysiology laboratory. Paroxysmal supraventricular tachycardias have an abrupt onset and offset, typically initiating and terminating with premature atrial ectopic beats. In the acute setting, both vagal maneuvers and pharmacologic therapy can be effective in arrhythmia termination. Catheter ablation has revolutionized therapy for many supraventricular tachycardias, and newer techniques have significantly improved ablation efficacy and decreased periprocedural complications and procedure times.

**Ventricular Arrhythmias**

Soufian T. AlMahameed and Ohad Ziv

Ventricular arrhythmias is commonly seen in medical practice. It may be completely benign or portend high risk for sudden cardiac death. Therefore, it is important that clinicians be familiar with and able to promptly recognize and manage ventricular arrhythmias when confronted with it clinically. In many cases, curative therapy for a given ventricular arrhythmia may be provided after a thorough understanding of the underlying substrate and mechanism. In this article, the authors broadly review the current classification of the different ventricular arrhythmias encountered in medical practice, provide brief background regarding the different mechanisms, and discuss practical diagnosis and management scenarios.

**Bradyarrhythmias for the Internist**

Noha Elbanhawy, Shajil Chalil, and Khalid Abozguia

In this article, the authors review the different types of sinus node and atrioventricular node diseases that lead to bradyarrhythmias with their associated symptoms, the diagnostic investigations needed to assess
the degree of disease, and the therapeutic management, including the indications for permanent pacing.

Sudden Cardiac Death: Who Is at Risk? 913
Mohammad-Ali Jazayeri and Martin P. Emert

Sudden cardiac death (SCD) is a leading cause of death in the United States. Despite improvements in therapy, the incidence of SCD as a proportion of overall cardiovascular death remains relatively unchanged. This article aims to answer the question, “Who is at risk for SCD?” In the process, it reviews the definition, pathophysiology, epidemiology, and risk factors of SCD. Patients at risk for SCD and appropriate treatment strategies are discussed.

Cardiac Implantable Electronic Device Therapy: Permanent Pacemakers, Implantable Cardioverter Defibrillators, and Cardiac Resynchronization Devices 931
Melanie M. Steffen, Jeffery S. Osborn, and Michael J. Cutler

Cardiac implantable electronic devices (CIEDs) provide lifesaving therapy for the treatment of bradyarrhythmias, ventricular tachyarrhythmias, and advanced systolic heart failure. Advances in CIED therapy have expanded the number of patients receiving permanent pacemakers, implantable cardioverter defibrillators, and cardiac resynchronization therapy devices. These devices improve quality of life and, in many cases, reduce mortality. However, limitations remain in the management of patients who require CIED therapy. This article provides a broad overview of CIED therapy in the management of the cardiac patient.

Arrhythmias in Congenital Heart Disease 945
Jessica Kline and Otto Costantini

Cardiac defects are the most common congenital defects, accounting for approximately 9 per 1000 births. Patients with structural heart disease related to congenital diseases are prone to develop intrinsic rhythm abnormalities as a result of altered physiology. In addition, they are at an increased risk of developing acquired arrhythmias secondary to the nature of surgical interventions done to improve physiologic function in the setting of these defects. Arrhythmia management and risk stratification pose particularly complex challenges to clinicians managing this population.