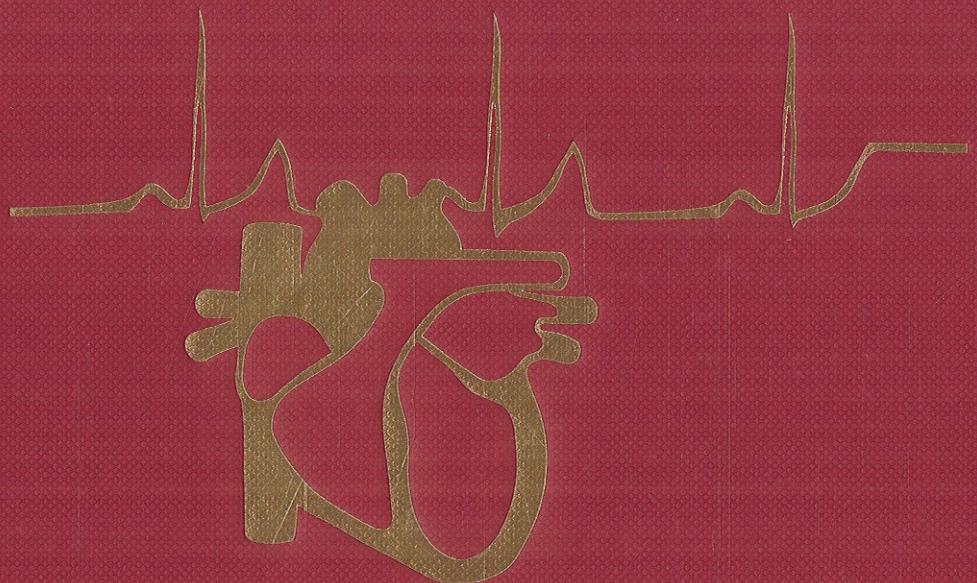


# Cardiac Nursing

SIXTH EDITION



Susan L. Woods  
Erika S. Sivarajan Froelicher  
Sandra Underhill Motzer  
Elizabeth J. Bridges



Wolters Kluwer  
Health

Lippincott  
Williams & Wilkins

**P A R T****Anatomy and Physiology 1****CHAPTER 1****Cardiac Anatomy and Physiology 1****Eleanor F. Bond**

- General Anatomic Description 1  
Cardiac Structures 2  
Cardiac Tissue 6  
Coronary Circulation 9  
Cardiac Innervation 13  
Myocardial Cell Structure 13  
Myocardial Cell Electrical Characteristics 14  
Cardiac Action Potential 18  
Sarcolemmal Ionic Currents 22  
Factors Modifying Electrophysiologic Function 24  
Propagation of the Cardiac Impulse 26  
Mechanical Characteristics of Cardiac Cells 29  
Mechanical Properties of the Myocardium 30  
Myocardial Metabolism 35  
Physiology of the Coronary Circulation 35  
The Cardiac Cycle 37

**CHAPTER 2****Systemic and Pulmonary Circulation and Oxygen Delivery 42****Elizabeth J. Bridges • Joseph O. Schmelz**

- Structural Characteristics of the Vasculature and Lymphatics 42  
Local Regulation 46  
Neurohumoral Stimulation 51  
Calcium 53  
Volume and Flow Distribution 54  
The Venous System 56  
Microcirculatory Exchange 56  
The Lymphatic System 58  
Pulmonary Circulation 58

**CHAPTER 3****Regulation of Cardiac Output and Blood Pressure 69****Elizabeth J. Bridges**

- Afferent Input and Receptor 69

- Central Nervous System Regulation 71  
Autonomic Nervous System Regulation 71  
Systemic Hormones 77  
Arterial Blood Pressure 80  
Heart Rate 80  
Intrinsic Cardiac Control 81  
Extrinsic Control: Pericardial Limitation 82  
Long-Term Control of Blood Pressure 83  
Local Regulation of Systemic Microvascular Beds 84  
Venous System 85  
Relation Between Cardiac Output and Central Venous Pressure—Retrograde Versus Antegrade Models 86  
Valsalva Maneuver 87  
Overall Control 88

**P A R T****Physiologic and Pathologic Responses 97****CHAPTER 4****Genetics 97****Bradley E. Aouizerat**

- DNA 97  
DNA and Human Diversity 99  
Genetic Variation 99  
Gene Testing 100  
The Human Genome Project 100  
Pharmacogenomics 100  
Biochemical Basis of Genetic Disease 100  
Overview: Heart Disease 101  
The Genetics of Cardiovascular Disease 102  
Evidence for a Genetic Basis of Coronary Artery Disease 103  
Diagnosis and Risk Assessment: Application of Genetic Susceptibility Information in the Prevention of Coronary Artery Disease 105  
Ethical Considerations 106  
Summary 106

## CHAPTER 5

Atherosclerosis, Inflammation, and Acute Coronary Syndrome 111

**Bradley E. Aouizerat • Polly E. Gardner • Gaylene Altman**

Introduction 111

Mechanisms that Regulate Coronary Blood Flow 111

Causes of Myocardial Ischemia and Infarction 112

Risk Factors for Coronary Artery Disease 122

Incidence of Myocardial Ischemia 122

Incidence of Myocardial Infarction 124

Implications for Nurses 126

## CHAPTER 6

Hematopoiesis, Coagulation, and Bleeding 132

**Nancy Munro**

Hematopoietic Cells 132

Hemostasis 135

Coagulation—Inflammation Link 138

Bleeding Disorders 139

Clotting Disorders 143

## CHAPTER 7

Fluid and Electrolyte and Acid–Base Balance and Imbalance 153

**Linda Felver**

Principles of Fluid Balance 153

Extracellular Fluid Volume Balance 154

Osmolality Balance 156

Principles of Electrolyte Balance 157

Electrolyte Imbalances 157

Summary Fluid and Electrolytes 165

Principles of Acid–Base Balance 166

Acid–Base Imbalances 167

Summary of Acid–Base 172

## CHAPTER 8

Sleep 177

**Kathy P. Parker • Rebecca A. Gary • Sandra B. Dunbar**

Introduction 177

Normal Sleep 177

Sleep Physiology 180

Clinical Evaluation, Diagnosis, and Approaches 182

Impaired Sleep, Sleep Disorders, and Excessive Daytime Sleepiness 183

Sleep in Patients with Cardiovascular Disease 188

Cardiac Events in Sleep 192

Nursing Care Goals 192

Sleep Promoting Interventions 193

The Health Care Providers' Sleep 197

Summary 197

## CHAPTER 9

Physiologic Adaptations with Aging 204

**Barbara S. Levine**

General Physiologic Changes 204

Cardiovascular Changes 206

Respiratory Changes 208

Renal Changes 209

Hepatic Changes 209

Effects of Aging on Pharmacokinetics 209

Summary 210

## PART III

Assessment of Heart Disease 211

## CHAPTER 10

History Taking and Physical Examination 211

**Barbara S. Levine**

Cardiovascular History 211

Physical Assessment 216

## CHAPTER 11

Laboratory Tests Using Blood 245

**Susan L. Reed**

Blood Specimen Collection 245

Biochemical Markers of Myocardial Injury 249

Blood Lipids 253

Additional Laboratory Tests Associated with Cardiac Disease 253

Hematologic Studies 256

Coagulation Studies 257

Arterial Blood Gases 259

Blood Chemistries 259

Selected Chemistries 261

Blood Cultures 263

Serum Concentration of Selected Drugs 263

## CHAPTER 12

Radiologic Examination of the Chest 267

**Jon S. Huseby • Denise Ledoux**

How X-Rays Work 267

Interpretation of Chest Radiographs 267

Chest Film Findings in Acute Care Determining Line, Tube, and Catheter Placement 268  
 Chest Film Findings in Cardiovascular Disease 268

## CHAPTER 13

### Echocardiography 277

**Peter J. Cawley**

Principles and Techniques of Echo 277  
 Echo Examination 279  
 Special Echo Techniques 284

## CHAPTER 14

### Nuclear, Magnetic Resonance, and Computed Tomography Imaging 291

**Laurie A. Soine • Peter J. Cawley**

Nuclear Cardiology 291  
 Magnetic Resonance Imaging 294  
 Computed Tomography 296  
 Conclusion 297

## CHAPTER 15

### Electrocardiography 300

**Carol Jacobson**

Electrical Conduction Through the Heart 300  
 Basic Electrocardiography 302  
 The 12-Lead ECG 304  
 Axis Determination 307  
 Intraventricular Conduction Abnormalities 309  
 Acute Coronary Syndrome 313  
 Atrial and Ventricular Enlargement 322  
 Electrolyte Imbalances 326  
 Drug Effects 327  
 Long QT Syndromes (LQTS) 327  
 Brugada Syndrome 328  
 Ventricular Preexcitation Syndromes 329

## CHAPTER 16

### Arrhythmias and Conduction Disturbances 333

**Carol Jacobson**

Mechanisms of Arrhythmias 333  
 Basic Arrhythmias and Conduction Disturbances 337  
 Complex Arrhythmias and Conduction Disturbances 364

## CHAPTER 17

### Heart Rate Variability 388

**Diana E. McMillan • Robert L. Burr**

Mechanisms of HRV 388  
 HRV Measurement 388

HRV Patterns in Common Cardiovascular Conditions 390  
 Factors Influencing HRV 393  
 Impact of Interventions on HRV 396  
 Summary 396

## CHAPTER 18

### Cardiac Electrophysiology Procedures 400

**Susan Blancher**

Diagnostic EP Studies 400  
 Interventional EP and Catheter Ablation 405  
 Nursing Care of the Patient Undergoing EP Procedures 416

## CHAPTER 19

### Exercise Testing 420

**Jonathan Myers**

Indications and Objectives 420  
 Safety and Personnel 420  
 Pretest Considerations 421  
 Exercise Test Selection 422  
 Interpretation of Exercise Test Responses 425  
 Test Termination 430  
 Recovery Period 431  
 Assessing Test Accuracy 431  
 Ancillary Methods for the Detection of CAD 432  
 Gas Exchange Techniques 434  
 Prognosis 434  
 Exercise Testing in Special Populations 434  
 Summary 435

## CHAPTER 20

### Cardiac Catheterization 439

**Michaelene Hargrove Deelstra • Carol Jacobson**

Indications for Cardiac Catheterization 439  
 Contraindications for Cardiac Catheterization 441  
 Patient Preparation 441  
 Procedure 443  
 Quantitative Angiography 450  
 Nursing Care of Patients Undergoing Cardiac Catheterization 453  
 Interpretation of Data 457

## CHAPTER 21

### Hemodynamic Monitoring 460

**Elizabeth J. Bridges**

Technical Aspects of Invasive Pressure Monitoring 460  
 Direct Arterial Pressure Monitoring 464  
 Ventricular Function Curves 468  
 CVP Monitoring 469  
 PA Pressure Monitoring 470  
 Functional Hemodynamic Indices 481

CO Measurement	485
Continuous Cardiac Output	487
Less Invasive Methods for CO Monitoring	488
Oxygen Supply and Demand	492

## PART IV

### Pathophysiology and Management of Heart Disease 511

#### CHAPTER 22

##### Acute Coronary Syndromes 511

**Jean Marie Blue Verrier • Michaelene Hargrove Deelstra**

Presentation of ACS 511

Initial Evaluation and Management of Patients with ACS 512

Coronary Revascularization Strategies and Reperfusion Therapies 516

Reperfusion Strategies for STEMI and UA/NSTEMI 521

Pharmacological Management of ACS 523

Complications of MI 527

Nursing Management of ACS 528

Nursing Management of Patients with RV Infarction 531

#### CHAPTER 23

##### Interventional Cardiology Techniques: Percutaneous Coronary Intervention 537

**Michaelene Hargrove Deelstra**

Patient Selection for PCI 537

Percutaneous Transluminal Coronary Angioplasty 538

Coronary Atherectomy, Atheroablative, and Thrombectomy Devices 539

Coronary Stents 540

Management of the Patient During PCI 542

Anticoagulation Options for PCI 544

Complications Associated with PCI 544

Restenosis 547

Adjunctive Modalities: Quantitative Angiography 548

Noncoronary Devices for Treatment of Congenital Heart Defects 548

Future Directions for PCI 550

Nursing Management of Patients Undergoing PCI 550

ECF Deficit Related to Contrast-Induced Diuresis,

Restricted Oral Intake, Hemorrhage from Delayed Coagulation 551

#### CHAPTER 24

##### Heart Failure and Cardiogenic Shock 555

**Laurie A. Soine**

Heart Failure 555

Cardiogenic Shock 578

#### CHAPTER 25

##### Cardiac Surgery 595

**Denise Ledoux • Helen Luikart**

Evolving Trends in Cardiac Surgery 595

Preoperative Assessment and Preparation 595

Surgical Techniques 596

Cardiac Surgery Procedures for Coronary Artery

Revascularization 597

Cardiac Surgery Procedures for Acquired Structural Heart Disease 600

Cardiac Transplantation 606

#### CHAPTER 26

##### Mechanical Circulatory Assist Devices 623

**Michael A. Chen**

Intra-Aortic Balloon Pump Counterpulsation 623

Other Mechanical Circulatory Assist Devices 628

#### CHAPTER 27

##### Sudden Cardiac Death and Cardiac Arrest 638

**Donna Gerity**

Definition of Sudden Death 638

Pathophysiology and Cause of SCA 638

Management of SCA 641

Survivors of Cardiac Arrest 649

#### CHAPTER 28

##### Pacemakers and Implantable Defibrillators 655

**Carol Jacobson • Donna Gerity**

Pacemakers 655

Implantable Cardioverter Defibrillators 683

Conclusion 701

#### CHAPTER 29

##### Acquired Valvular Heart Disease 705

**Denise Ledoux**

Definition, Classification, and Epidemiology 705

Causes of Acquired Valvular Heart Disease 705

Diagnostic Testing for Valvular Heart Disease	707
Mitral Stenosis	707
Tricuspid Valve Disease	710
Prosthetic Valves	711
Mitral Insufficiency	713
Mitral Valve Prolapse	715
Aortic Stenosis	717
Aortic Insufficiency	719

## CHAPTER 30

### Pericardial, Myocardial, and Endocardial Disease 722

**Margaret M. McNeill**

Pericardial Disease	722
Cardiomyopathies	728
Endocardial Disease	732

## CHAPTER 31

### Adult Congenital Heart Disease 738

**Philip Moons • Mary M. Canobbio**

Incidence and Prevalence	738
Categorization of Congenital Heart Defects	738
Acyanotic Heart Defects with Left-to-Right Shunt	738
Acyanotic Heart Defects with Left Heart Obstruction	742
Acyanotic Heart Defects with Right Heart Obstruction	744
Malposition and Malconnection	745
Cyanotic Heart Defects with Diminished Pulmonary Blood Flow	746
Cyanotic Heart Defects with Increased Pulmonary Blood Flow	747
Cyanotic Heart Defects with Common Mixing	748
Eisenmenger Reaction	750

## PART V

### Health Promotion and Disease Prevention 753

## CHAPTER 32

### Coronary Heart Disease Risk Factors 753

**M. Kaye Kramer • Katherine M. Newton • Erika S. Sivarajan Froelicher**

Demographic Characteristics	753
Family History of Cardiovascular Disease	755
Cigarette Smoking	755
Hypertension	756
Serum Lipids and Lipoproteins	756
Physical Activity	758

Diabetes Mellitus	759
Body Weight	761
Reproductive Hormones	762
Folate and Homocysteine	763
Antioxidants	763
Conclusions	764

## CHAPTER 33

### Psychosocial Risk Factors: Assessment and Management Interventions 769

**Simone K. Madan • Erika S. Sivarajan Froelicher**

Psychosocial Risk Factors for CHD	769
Pathophysiological Mechanisms for Psychosocial Risk Factors and CHD	771
Assessment of Psychosocial Risk Factors Related to CHD	772
Psychosocial Interventions in CHD	775
Pharmacological Interventions for Psychosocial Risk Factors in CHD	778
Summary	779

## CHAPTER 34

### Smoking Cessation and Relapse Prevention 783

**Min Sohn • Mark Hawk • Kirsten Martin • Erika S. Sivarajan Froelicher**

Harmful Effects of Smoking	783
Benefits of Smoking Cessation	784
Theoretical Framework for Smoking Cessation	784
Smoking Cessation Interventions in the CHD Population	784
General Trends in Smoking Cessation Interventions	785
Treating Tobacco Use and Dependence: Clinical Practice Guideline	785
Special Areas on which to Focus	793
Summary	795

## CHAPTER 35

### Hypertension 799

**Cheryl R. Dennison • Nancy Houston Miller • Susanna G. Cunningham**

Evidence for Management	799
Management of HTN	804
Summary	817

## CHAPTER 36

### Lipid Management and Cardiovascular Disease 823

**Kathleen A. Berra • Joan M. Fair**

Blood Lipids: Structure and Functions	823
Lipid Metabolism and Transport	825

Reverse Cholesterol Transport	826
LDL Variants	827
Cholesterol and Endothelial Function	827
Dyslipidemic Disorders	827
Hypercholesterolemia	827
The Management of High Blood Cholesterol	829
Evaluation of the Patient with Elevated Cholesterol	831
Lipoprotein Measurement	832
Dietary Management of Hyperlipidemia	832
Weight Control and Lipid Management	834
Alcohol and Lipoproteins	835
Physical Activity and Lipoproteins	835
Hormones and Lipoproteins	835
Pharmacologic Management of Hyperlipidemia	836

## CHAPTER 37

### Exercise and Activity 842

**Jonathan Myers**

Role of Exercise in Cardiovascular Health	842
Cardiac Rehabilitation	847
Closing Comment	858

## CHAPTER 38

### Obesity: An Overview of Assessment and Treatment 861

**Lora E. Burke • Patricia K. Tuite • Melanie Warziski Turk**

Identification and Assessment of the Overweight or Obese Patient	861
Clinical Evaluation	864
Treatment of Overweight and Obesity	866
Summary	872

## CHAPTER 39

### Diabetes Mellitus and Metabolic Syndrome 876

**Beverly Dyck Thomassian**

Overview of Diabetes	876
Pathophysiology of Diabetes Mellitus	877
Macrovascular Complications of Diabetes	882
Nursing Management of Diabetes	882
Summary	886

## CHAPTER 40

### Adherence to Cardiovascular Treatment Regimens 889

**Lora E. Burke • Kyeongra Yang • Sushama D. Acharya**

Significance of Nonadherence	889
Methods of Measurement	890

Determinants of Adherence	894
Models of Behavior Change	896
Adherence-Enhancing Strategies	896
Educational Strategies to Improve Adherence	899
Questionnaires Relevant to Adherence-Enhancing Interventions	899
Building a Therapeutic Relationship with the Patient	900
Summary	901

## CHAPTER 41

### Complementary and Alternative Approaches in Cardiovascular Disease 906

**Eleanor F. Bond • Shannon M. Latta**

CAM Definitions and Characteristics	906
CAM Domains	906
Prevalence of CAM	906
Whole Medical Systems	908
Mind Body Interventions for Cardiovascular Health	911
Biologically Based Treatments	912
Manipulative, Body-Based Methods and Energy Therapies	916
Legal Aspects of CAM	917
Integration of CAM into Nursing Assessment and Clinical Management	917
Summary	917

## CHAPTER 42

### Disease Management Models for Cardiovascular Care 921

**Nancy Houston Miller • Erika S. Sivarajan Froelicher**

Disease Management: Definition and Models	922
Components of Disease Management Systems	924
Training and Job Qualifications for Disease Management	927
The Unresolved Issues for Disease Management	928

## CHAPTER 43

### Global Cardiovascular Health 933

**Kawkab Shishani •**

**Erika S. Sivarajan Froelicher**

Introduction to Global Health	933
Controlling the CVD Epidemic	933
Summary	936

### Appendix A 938

### Index 941