Volume 1

BRUNNER & SUDDARTH'S

TEXTBOOK OF Medical-Surgical Nursing

15TH EDITION

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To our fellow nurses who provide comfort and care, and who instill hope for a healthier world . . .

To our nursing faculty colleagues who nurture, guide, and steer the future of our profession . . .

To nursing students who challenge themselves with courage and conviction . . .

You inspire us!

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Preface

Since 1964, when Lillian Sholtis Brunner and Doris Smith Suddarth introduced the first edition of the *Textbook of Medical-Surgical Nursing*, the practice of nursing has flexed, changed, evolved, and advanced to meet changing health needs and expectations for health care. With each subsequent edition of this textbook, Lillian and Doris, and their successors, Suzanne Smeltzer and Brenda Bare (and eventually we, the current authors), admirably updated and revised content to reflect changes and challenges that shaped the practice of nursing, considering complex and interconnected influences and maintaining a focus upon salient social, cultural, economic, and environmental factors. Never have we, nor our distinguished and capable predecessors, had to revise and update seminal medical-surgical nursing concepts, principles, and practices during a global pandemic—until now. Most assuredly, this has been a daunting task. Yet, compared to what many of our phenomenally creative, determined, and resilient professional colleagues have had to confront and contend with as a result of this pandemic, our work was much less onerous. We would also like to recognize the long overdue and growing awareness of structural racism within healthcare and the impact of systemic racism on perpetuating stereotypes and health disparities. We encourage nurse educators and students to thoughtfully consider and discuss these issues when exploring epidemiological factors of specific disorders and nursing care throughout the textbook. Now that we have sent this edition to print and have time to reflect upon our work, we find ourselves humbled to call ourselves your peers and so proud of the important and sacred work that you do today and every day. We have decided to break with a long tradition in this textbook that tends to not provide dedications. To YOU our fellow nurses, nursing faculty, and nursing students, we dedicate this book.

Organization

Brunner & Suddarth's Textbook of Medical-Surgical Nursing, 15th Edition, is organized into 16 units. These units mirror those found in previous editions with the incorporation of some changes. Content was updated throughout all units, with cross-references to specific chapters included as appropriate. Units 1 through 3 cover foundational principles and core concepts related to medical-surgical nursing practice. Units 4 through 15 discuss adult health conditions that are treated medically or surgically. Unit 16 describes community-based challenges that affect medical-surgical nursing practice.

Units 4 through 15 are structured in the following way to better facilitate comprehension:

- The first chapter in the unit covers assessment and includes a review of normal anatomy and physiology of the body system being discussed.
- Subsequent chapters in the unit cover management of specific disorders. Pathophysiology, clinical manifestations, assessment and diagnostic findings, medical management, and nursing management are presented. Nursing Process sections, provided for select conditions, clarify and expand on the nurse's role in caring for patients with these conditions.

There are fewer chapters in this edition than in the past several editions; however, the seminal content within the deleted chapters remains, and is updated and revised. Notably, core content in previous-edition chapters that focused exclusively on *therapeutic modalities* has now been incorporated into chapters focused on health conditions and disorders, where its application dovetails seamlessly into nursing management and the nursing process. Thus, the application of these modalities to medical-surgical nursing practice is readily apparent.

Special Features

When caring for patients, nurses assume many different roles, including practitioner, educator, advocate, and researcher. Many of the features in this textbook have been developed to help nurses fulfill these varied responsibilities. Key updates to practice-oriented features in the 15th edition include new unit-opening Case Studies with QSEN Competency Focus—a feature that highlights a competency from the Quality and Safety Education for Nurses (QSEN) Institute that is applicable to the case study and poses questions for students to consider about relevant knowledge, skills, and attitudes (KSAs). Quality and Safety Nursing Alerts, Genetics in Nursing Practice charts, Ethical Dilemma charts, and Home Care Checklist charts offer updated information.

Plans of Nursing Care, provided for select disorders, illustrate how the nursing process is applied to meet the patient's health care and nursing needs. New to the 15th edition, nursing diagnoses used in the Plans of Nursing Care and throughout the textbook are those devised and validated by the International Council of Nurses in the *International Classification for Nursing Practice (ICNP) Catalogue*. (Please note that because of the global foci of these nursing diagnoses, select terms in these diagnoses are spelled in the British manner.)

A new addition to the textbook this cycle is a chapter focused exclusively on the unique health care needs of persons who identify as lesbian, gay, bisexual, transgender, and/or queer (LGBTQ). As is the case with other chapters of this textbook, the roles of the professional nurse as a practitioner, educator, advocate, and researcher when providing care for persons who are LGBTQ provide the framework for this new chapter.

In addition, two new features in this edition highlight content related to COVID-19 and care of veterans. *COVID-19 Considerations* sections identify evidence-based information at the time this material was written related to the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) or the nursing care of patients with coronavirus disease 2019 (COVID-19). *Veterans Considerations* sections include information applicable to the special care needs of military

veterans. Veterans—who may include persons from all age groups, genders, races, and socioeconomic strata—may have unique health risks based upon dates of service and assignment locale.

The textbook also provides pedagogical features developed to help readers engage and learn critical content. Concept Mastery Alerts continue to clarify fundamental nursing concepts to improve the reader's understanding of potentially confusing topics, as identified by Misconception Alerts in Lippincott's Adaptive Learning Powered by PrepU. An enhanced suite of online, interactive multimedia resources is also highlighted with icons placed in text near relevant topics. Unfolding Patient Stories (case study vignettes) based on vSim for Nursing patients are part of this suite of resources.

Read the User's Guide that follows the Preface for a full explanation and visual representation of all special features. See also the "Special Charts in This Book" and "Case Studies in This Book" sections of this front matter for the location of these items in the text.

A Comprehensive Package for Teaching and Learning

To further facilitate teaching and learning, a carefully designed ancillary package has been developed to assist faculty and students.

Instructor Resources

Tools to assist you with teaching your course are available upon adoption of this text on thePoint at http://thepoint.lww.com/Brunner15e.

- An **e-Book** on thePoint gives you access to the book's full text and images online.
- A thoroughly revised and augmented **Test Generator** contains more than 2900 NCLEX-style questions mapped to chapter learning outcomes.
- An extensive collection of materials is provided for each book chapter:
  - **Lesson Plans** outline learning outcomes and identify relevant resources from the robust instructor and student resource packages to help you prepare for your class.
  - **Pre-Lecture Quizzes** (and answers) allow you to check students' reading.
  - **PowerPoint Presentations** provide an easy way to integrate the textbook with your students' classroom experience; multiple-choice and true/false questions are included to promote class participation.
  - **Guided Lecture Notes** are organized by outcome and provide corresponding PowerPoint slide numbers to simplify preparation for lecture.
  - **Discussion Topics** (and suggested answers) can be used in the classroom or in online discussion boards to facilitate interaction with your students.
  - **Assignments** (and suggested answers) include group, written, clinical, and Web assignments to engage students in varied activities and assess their learning.
  - **Case Studies** with related questions (and suggested answers) give students an opportunity to apply their knowledge to a client case similar to one they might encounter in practice.
- Sample **Syllabi** are provided for one- and two-semester courses.
- A **QSEN Competency Map** identifies content and special features in the book related to competencies identified by the QSEN Institute.
- An **Image Bank** lets you use the photographs and illustrations from this textbook in your course materials.
- Access to all **Student Resources** is provided so that you can understand the student experience and use these resources in your course as well.

Student Resources

An exciting set of free learning resources is available on thePoint to help students review and apply vital concepts in medical-surgical nursing. Multimedia engines have been optimized so that students can access many of these resources on mobile devices. Students can access all these resources at http://thepoint.lww.com/Brunner15e using the codes printed in the front of their textbooks.

- **NCLEX-Style Review Questions** for each chapter, totaling more than 1800 questions, help students review important concepts and practice for NCLEX.
- Interactive learning resources appeal to a variety of learning styles. Icons in the text direct readers to relevant resources:
  - **Concepts in Action Animations** bring physiologic and pathophysiologic concepts to life.
  - **Practice & Learn Case Studies** present case scenarios and offer interactive exercises and questions to help students apply what they have learned.
  - **Watch & Learn Video Clips** reinforce skills from the textbook and appeal to visual and auditory learners.
- **Procedural Guidelines charts** review key nursing interventions and rationales for specific patient care situations.
- **Appendix A, Diagnostic Studies and Interpretation**, provides reference ranges and lab values for common laboratory tests.
- **Journal Articles** offer access to current articles relevant to each chapter and available in Wolters Kluwer journals to familiarize students with nursing literature.

Study Guide

A comprehensive study aid for reviewing key concepts, ***Study Guide for Brunner & Suddarth's Textbook of Medical-Surgical Nursing*, 15th Edition**, has been thoroughly revised and presents a variety of exercises, including case studies and practice NCLEX-style questions, to reinforce textbook content and enhance learning.

vSim for Nursing

Available for separate purchase, vSim for Nursing, jointly developed by Laerdal Medical and Wolters Kluwer, offers innovative scenario-based learning modules consisting of Web-based virtual simulations, course learning materials, and curriculum tools designed to develop critical thinking skills and promote clinical confidence and competence. vSim for Nursing | Medical-Surgical includes 10 virtual simulations based on the National League for Nursing Volume I Complex patient scenarios. Students can progress through suggested readings, pre- and postsimulation assessments, documentation

assignments, and guided reflection questions, and will receive an individualized feedback log immediately upon completion of the simulation. Throughout the student learning experience, the product offers remediation back to trusted Lippincott resources, including *Brunner & Suddarth's Textbook of Medical-Surgical Nursing*, as well as Lippincott Nursing Advisor and Lippincott Nursing Procedures—two online, evidence-based, clinical information solutions used in health care facilities throughout the United States. This innovative product provides a comprehensive patient-focused solution for learning and integrating simulation into the classroom.

Contact your Wolters Kluwer sales representative or visit http://thepoint.lww.com/vsim for options to enhance your medical-surgical nursing course with vSim for Nursing.

Lippincott DocuCare

Available for separate purchase, Lippincott DocuCare combines Web-based academic EHR simulation software with clinical case scenarios, allowing students to learn how to use an EHR in a safe, true-to-life setting, while enabling instructors to measure their progress. Lippincott DocuCare's nonlinear solution works well in the classroom, simulation lab, and clinical practice.

Contact your Wolters Kluwer sales representative or visit http://thepoint.lww.com/DocuCare for options to enhance your medical-surgical nursing course with DocuCare.

A Comprehensive, Digital, Integrated Course Solution

Lippincott® CoursePoint+ is an integrated, digital curriculum solution for nursing education that provides a completely interactive experience geared to help students understand, retain, and apply their course knowledge and be prepared for practice. The time-tested, easy-to-use, and trusted solution includes engaging learning tools, evidence-based practice, case studies, and in-depth reporting to meet students where they are in their learning, combined with the most trusted nursing education content on the market to help prepare students for practice. This easy-to-use digital learning solution of *Lippincott® CoursePoint+*, combined with unmatched support, gives instructors and students everything they need for course and curriculum success!

Lippincott® CoursePoint+ includes:

- Leading content provides a variety of learning tools to engage students of all learning styles.
- A personalized learning approach gives students the content and tools they need at the moment they need it, giving them data for more focused remediation and helping to boost their confidence and competence.
- Powerful tools, including varying levels of case studies, interactive learning activities, and adaptive learning powered by PrepU, help students learn the critical thinking and clinical judgment skills to help them become practice-ready nurses.
- Preparation for Practice tools improve student competence, confidence, and success in transitioning to practice.
  - vSim for Nursing: Co-developed by Laerdal Medical and Wolters Kluwer, vSim for Nursing simulates real nursing scenarios and allows students to interact with virtual patients in a safe, online environment.
  - Lippincott Advisor for Education: With over 8500 entries covering the latest evidence-based content and drug information, Lippincott Advisor for Education provides students with the most up-to-date information possible, while giving them valuable experience with the same point-of-care content they will encounter in practice.
- Unparalleled reporting provides in-depth dashboards with several data points to track student progress and help identify strengths and weaknesses.
- Unmatched support includes training coaches, product trainers, and nursing education consultants to help educators and students implement CoursePoint+ with ease.

Janice L. Hinkle, PhD, RN, CNRN
Kerry H. Cheever, PhD, RN
Kristen J. Overbaugh, PhD, RN, ACNS-BC, CHPN

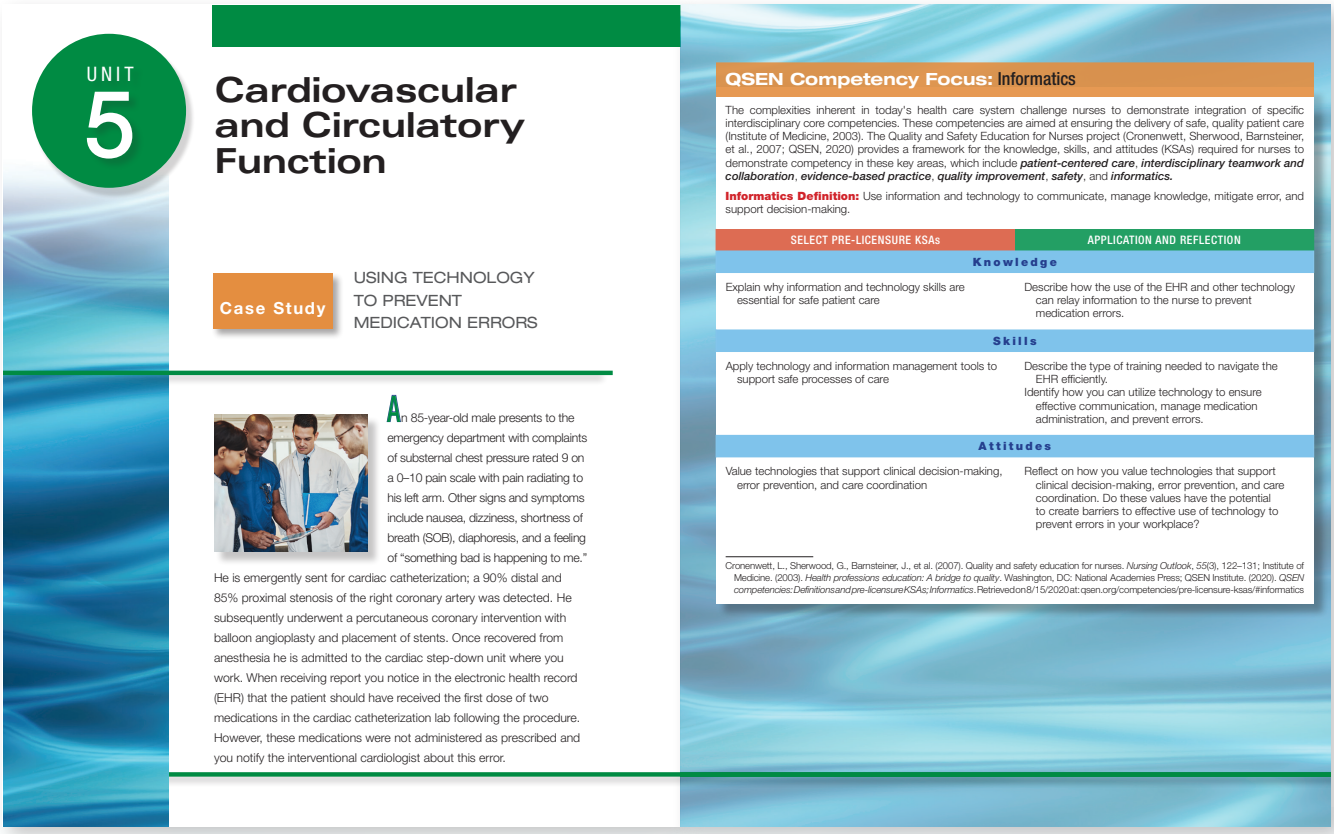
User's Guide

Brunner & Suddarth's Textbook of Medical-Surgical Nursing, 15th Edition, has been revised and updated to reflect the complex nature of nursing practice today. This textbook includes many features to help you gain and apply the knowledge that you need to pass NCLEX and successfully meet the challenges and opportunities of clinical practice. In addition, features have been developed specifically to help you fulfill the varied roles that nurses assume in practice.

Opening Features That Start with the End in Mind

Unit-opening features put the patient first and highlight competent nursing as well as application of the nursing process.

- **All new! A Case Study with QSEN Competency Focus** opens each unit and provides discussion points focusing on one competency from the QSEN Institute: patient-centered care, interdisciplinary teamwork and collaboration, evidence-based practice, quality improvement, safety, or informatics. This feature helps you consider the KSAs required for the delivery of safe, quality patient care. For your convenience, a list of these case studies, along with their location in the book, appears in the "Case Studies in This Book" section later in this front matter.



UNIT 5

Cardiovascular and Circulatory Function

Case Study

USING TECHNOLOGY TO PREVENT MEDICATION ERRORS

An 85-year-old male presents to the emergency department with complaints of substernal chest pressure rated 9 on a 0–10 pain scale with pain radiating to his left arm. Other signs and symptoms include nausea, dizziness, shortness of breath (SOB), diaphoresis, and a feeling of "something bad is happening to me." He is emergently sent for cardiac catheterization; a 90% distal and 85% proximal stenosis of the right coronary artery was detected. He subsequently underwent a percutaneous coronary intervention with balloon angioplasty and placement of stents. Once recovered from anesthesia he is admitted to the cardiac step-down unit where you work. When receiving report you notice in the electronic health record (EHR) that the patient should have received the first dose of two medications in the cardiac catheterization lab following the procedure. However, these medications were not administered as prescribed and you notify the interventional cardiologist about this error.

QSEN Competency Focus: Informatics

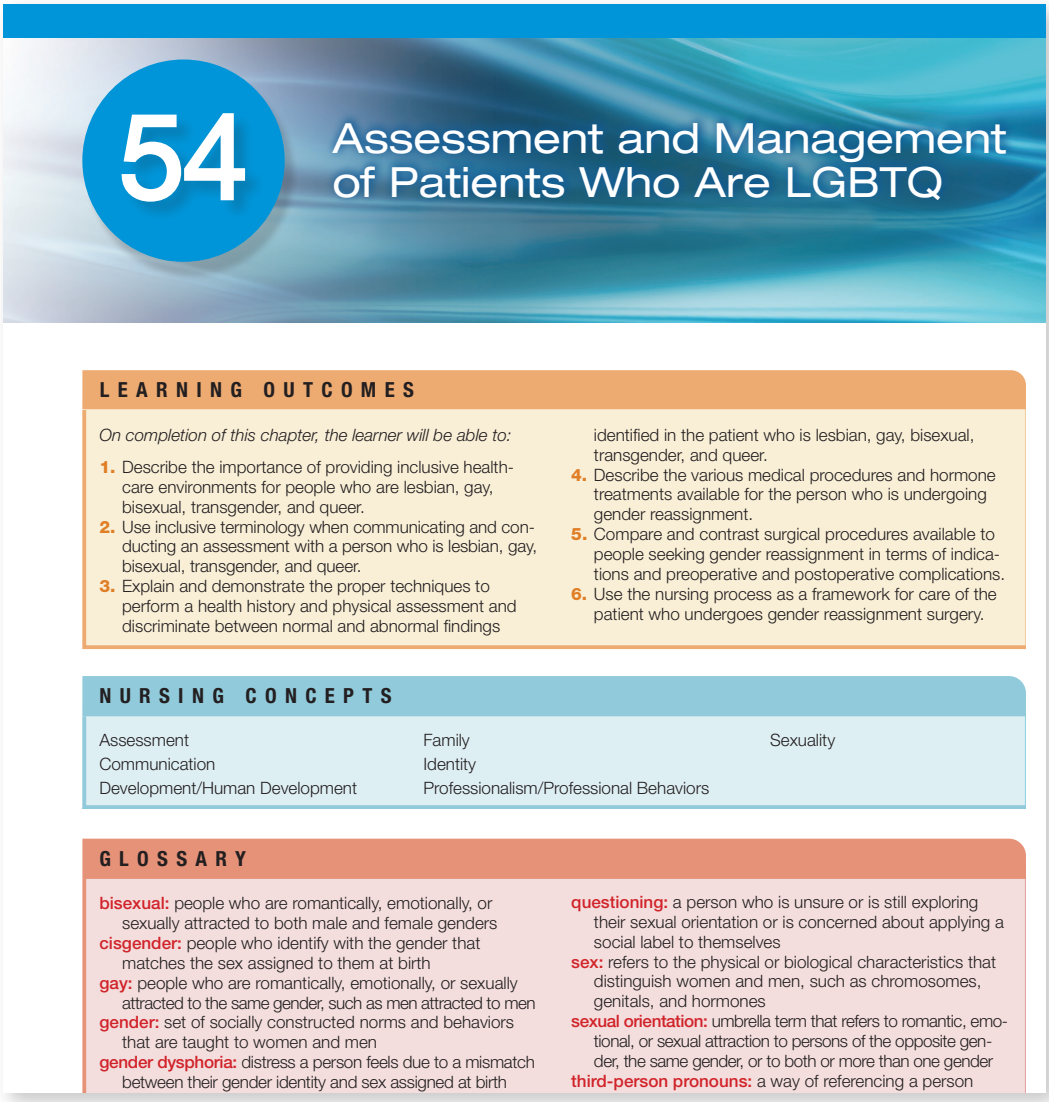
The complexities inherent in today's health care system challenge nurses to demonstrate integration of specific interdisciplinary core competencies. These competencies are aimed at ensuring the delivery of safe, quality patient care (Institute of Medicine, 2003). The Quality and Safety Education for Nurses project (Cronenwett, Sherwood, Barnsteiner, et al., 2007; QSEN, 2020) provides a framework for the knowledge, skills, and attitudes (KSAs) required for nurses to demonstrate competency in these key areas, which include ***patient-centered care***, ***interdisciplinary teamwork and collaboration***, ***evidence-based practice***, ***quality improvement***, ***safety***, and ***informatics.***

Informatics Definition: Use information and technology to communicate, manage knowledge, mitigate error, and support decision-making.

SELECT PRE-LICENSURE KSAs	APPLICATION AND REFLECTION
Knowledge	
Explain why information and technology skills are essential for safe patient care	Describe how the use of the EHR and other technology can relay information to the nurse to prevent medication errors.
Skills	
Apply technology and information management tools to support safe processes of care	Describe the type of training needed to navigate the EHR efficiently. Identify how you can utilize technology to ensure effective communication, manage medication administration, and prevent errors.
Attitudes	
Value technologies that support clinical decision-making, error prevention, and care coordination	Reflect on how you value technologies that support clinical decision-making, error prevention, and care coordination. Do these values have the potential to create barriers to effective use of technology to prevent errors in your workplace?

Cronenwett, L., Sherwood, G., Barnsteiner, J., et al. (2007). Quality and safety education for nurses. *Nursing Outlook, 55*(3), 122–131; Institute of Medicine. (2003). *Health professions education: A bridge to quality*. Washington, DC: National Academies Press; QSEN Institute. (2020). *QSEN competencies: Definitions and pre-licensure KSAs; Informatics*. Retrieved on 8/15/2020 at: qsen.org/competencies/pre-licensure-ksas/#informatics

- **Learning Outcomes**, succinctly focused and condensed in this edition, provide an overview of each chapter and identify what you will be able to do after completing the material, to help focus reading and studying.
- **NEW! Nursing Concepts** listed at the beginning of each chapter make clear how content applies to Concepts-based curricula.
- A **Glossary** provides a list of key terms and definitions at the beginning of each chapter, providing a review of vocabulary words before reading the material and a useful reference and study tool.



54 Assessment and Management of Patients Who Are LGBTQ

LEARNING OUTCOMES

On completion of this chapter, the learner will be able to:

1. Describe the importance of providing inclusive healthcare environments for people who are lesbian, gay, bisexual, transgender, and queer.
2. Use inclusive terminology when communicating and conducting an assessment with a person who is lesbian, gay, bisexual, transgender, and queer.
3. Explain and demonstrate the proper techniques to perform a health history and physical assessment and discriminate between normal and abnormal findings identified in the patient who is lesbian, gay, bisexual, transgender, and queer.
4. Describe the various medical procedures and hormone treatments available for the person who is undergoing gender reassignment.
5. Compare and contrast surgical procedures available to people seeking gender reassignment in terms of indications and preoperative and postoperative complications.
6. Use the nursing process as a framework for care of the patient who undergoes gender reassignment surgery.

NURSING CONCEPTS

Assessment
Communication
Development/Human Development
Family
Identity
Professionalism/Professional Behaviors
Sexuality

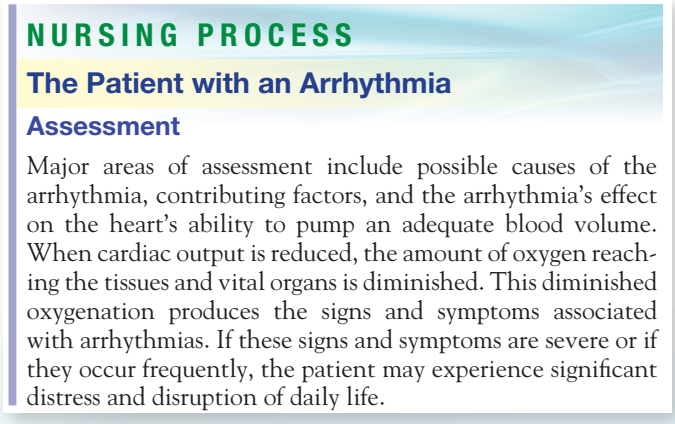
GLOSSARY

bisexual: people who are romantically, emotionally, or sexually attracted to both male and female genders
cisgender: people who identify with the gender that matches the sex assigned to them at birth
gay: people who are romantically, emotionally, or sexually attracted to the same gender, such as men attracted to men
gender: set of socially constructed norms and behaviors that are taught to women and men
gender dysphoria: distress a person feels due to a mismatch between their gender identity and sex assigned at birth
questioning: a person who is unsure or is still exploring their sexual orientation or is concerned about applying a social label to themselves
sex: refers to the physical or biological characteristics that distinguish women and men, such as chromosomes, genitals, and hormones
sexual orientation: umbrella term that refers to romantic, emotional, or sexual attraction to persons of the opposite gender, the same gender, or to both or more than one gender
third-person pronouns: a way of referencing a person

Features to Develop the Nurse as Practitioner

One of the central roles of the nurse is to provide holistic care to patients and their families, both independently and through collaboration with other health care professionals. Special features throughout chapters are designed to assist readers with clinical practice.

- **Nursing Process sections** are organized according to the nursing process framework—the basis for all nursing practice—and help clarify the nurse's responsibilities in caring for patients with select disorders.



NURSING PROCESS

The Patient with an Arrhythmia

Assessment

Major areas of assessment include possible causes of the arrhythmia, contributing factors, and the arrhythmia's effect on the heart's ability to pump an adequate blood volume. When cardiac output is reduced, the amount of oxygen reaching the tissues and vital organs is diminished. This diminished oxygenation produces the signs and symptoms associated with arrhythmias. If these signs and symptoms are severe or if they occur frequently, the patient may experience significant distress and disruption of daily life.

- **Plans of Nursing Care**, provided for select disorders, illustrate how the nursing process is applied to meet the patient's health care and nursing needs.

Chart 45-4 PLAN OF NURSING CARE
Care of the Patient with Hypothyroidism

NURSING DIAGNOSIS: Impaired breathing associated with depressed ventilation
GOAL: Improved respiratory status and maintenance of normal breathing pattern

Nursing Interventions	Rationale	Expected Outcomes
1. Assess respiratory rate, depth, pattern, pulse oximetry, and arterial blood gases.	1. Identifies patient's baseline to monitor further changes and evaluate effectiveness of interventions.	• Shows improved respiratory status and normal respiratory rate, depth, and pattern
2. Encourage deep breathing, coughing, and the use of incentive spirometry.	2. Prevents atelectasis and promotes adequate ventilation.	• Takes deep breaths, coughs and uses incentive spirometry
3. Verify with the provider orders to administer any hypnotic and sedative until euthyroid state achieved. If these medications are needed, monitor for adverse side effects.	3. Patients with hypothyroidism are susceptible to respiratory depression with the use of hypnotics and sedatives.	• Explains rationale for cautious use of medications • Maintains adequate oxygenation
4. Maintain patient airway through suction and ventilator support if needed (see Chapter 19 for care of patients requiring mechanical ventilation).	4. The use of artificial airway and ventilator support may be necessary.	

- **Assessment charts** focus on data that should be collected as part of the assessment step of the nursing process.

Chart 35-3 ASSESSMENT
Assessing for Peripheral Nerve Function

Assessment of peripheral nerve function has two key elements: evaluation of sensation and evaluation of motion. The nurse may perform one or all of the following during a musculoskeletal assessment.

Nerve	Test of Sensation	Test of Movement
Peroneal	Prick the skin midway between the great and second toe.	Ask the patient to dorsiflex the foot and extend the toes.

- **Risk Factors charts** outline factors that can impair health and should be considered in the context of social determinants of health and systemic racism.

Chart 49-1 RISK FACTORS
Urinary Tract Infection

- Contributing conditions such as:
  - Female gender
  - Diabetes
  - Pregnancy
  - Neurologic disorders
  - Gout
  - Altered states caused by incomplete emptying of the bladder and urinary stasis
- Decreased natural host defenses or immunosuppression
- Inability or failure to empty the bladder completely
- Inflammation or abrasion of the urethral mucosa
- Instrumentation of the urinary tract (e.g., catheterization, cystoscopic procedures)
- Obstructed urinary flow caused by:
  - Congenital abnormalities
  - Urethral strictures
  - Contracture of the bladder neck
  - Bladder tumors
  - Calculi (stones) in the ureters or kidneys
  - Compression of the ureters

- **Genetics in Nursing Practice charts** summarize and highlight nursing assessments and management issues related to the role of genetics in select disorders.

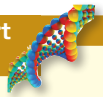


Chart 8-1 GENETICS IN NURSING PRACTICE

Genetics Concepts and the Older Adult

Genetic conditions in the older adult may occur from a specific gene mutation or arise as a result of a genetic predisposition combined with other factors (multifactorial). The following are examples of some adult-onset genetic conditions:

- Colon cancer
- Hemochromatosis
- Huntington disease
- Polycystic kidney disease
- Alzheimer's disease

The following are some examples of diseases with multifactorial components, which may include a genetic predisposition, in the older adult:

- Diabetes
- Emphysema
- Heart disease

Nursing Assessments

Refer to Chapter 4, Chart 4-2: Genetics in Nursing Practice: Genetic Aspects of Health Assessment

Family History Assessment Specific to the Older Adult

- Collect and assess family history on both maternal and paternal sides of the family for three generations.
- Determine whether genetic testing has occurred with other family members.
- Assess for individual and family perceptions and beliefs around topics related to genetics.

Patient Assessment Specific to the Older Adult and Genetic Illness

- Assess older adult patient's knowledge and understanding of genetics, genetic testing, and gene-based therapies.
- Assess the patient's understanding of genetic information and decipher health literacy needs.
- Perform cultural, social, and spiritual assessment.
- Assess patient's communication capacities so that communication strategies about genetics are tailored to their needs and abilities.
- Identify patient's support system.

Management Issues Specific to Genetics and the Older Adult

- Refer for further genetic counseling and evaluation as warranted so that family members can discuss inheritance, risk to other family members, and availability of genetic testing and gene-based interventions.
- Offer appropriate genetic information and resources that take into consideration older patient's literacy needs.
- Evaluate older patient's understanding before, during, and after the introduction of genetic information and services.
- Take the time to clearly explain the concepts of genetic testing to older patients and provide written information that reinforces the topic of discussion.
- Participate in the management and coordination of care of older patients with genetic conditions and individuals predisposed to develop or pass on a genetic condition.

Genetics Resources

See Chapter 6, Chart 6-7: Components of Genetic Counseling for additional resources.

- **Pharmacology charts and tables** display important considerations related to administering medications and monitoring drug therapy.

TABLE 42-2 Medications Prescribed to Treat Obesity

Medication	Adverse Effects	Nursing Considerations[a]
Gastrointestinal Lipase Inhibitor		
Mechanism of Action: Diminishes intestinal absorption and metabolism of fats, particularly triglycerides		
Orlistat *Note: Also available in lower dosages over-the-counter*	Diarrhea Flatus Oily stools Fecal incontinence	Patients may have associated problems with malabsorption of nutrients; advise them to take a concomitant daily multivitamin. Caution in patients with known history of renal insufficiency, liver disease, or gallbladder disease as concomitant use is associated with renal calculi, liver failure, and cholelithiasis. Do not administer with cyclosporine.
Selective Serotonin Receptor Agonist		
Mechanism of Action: Stimulates serotonin 5-HT2C receptors, causing excretion of the alpha-melanocortin–stimulating hormone (alpha-MSH) and elicits appetite suppression		
Lorcaserin	Fatigue Dizziness Nausea Headaches Cough Dry mouth Constipation	Encourage patient to stay well hydrated. Can be associated with deficits in attention or memory; administer with caution in patients who drive or work with hazardous equipment when first prescribed until effects are realized. Can cause hypoglycemia in patients with diabetes. Contraindicated for patients taking antidepressants or migraine medications due to synergistic effects. Discontinue in patients who express suicidal ideation. Rarely, serotonin syndrome may develop—be alert for high fevers, brisk reflexes, agitation, and diarrhea; notify primary provider immediately and hold medication if these occur.

- **Updated! Quality and Safety Nursing Alerts** offer tips for best clinical practice and red-flag safety warnings to help avoid common mistakes.

Quality and Safety Nursing Alert

Any signed form required for surgery is placed in a prominent place on the patient's medical record and accompanies the patient to the OR.

- **NEW! COVID-19 Considerations sections** identify evidence-based information at the time this material was written related to the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) or the nursing care of patients with coronavirus disease 2019 (COVID-19).

COVID-19 Considerations

The coronavirus disease 2019 (COVID-19) pandemic began in Wuhan, China, in late 2019. Since that time, several risks for both severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection and pathogenesis to coronavirus disease (COVID-19) have been posed. Epidemiologic findings from early data in China suggest that having a history of hypertension could be an important risk factor for becoming infected with SARS-CoV-2 as well as for being hospitalized to manage COVID-19 (Guo, Huang, Lin, et al., 2020;

- **NEW! Veterans Considerations sections** highlight information applicable to the special care needs of veterans of the military. Veterans—who may include persons from all age groups, genders, races, and socioeconomic strata—may have unique health risks, based upon dates of service and assignment locale.

Veterans Considerations

Many American veterans who served in Iraq and Afghanistan are experiencing respiratory disorders as a result of exposure to pollutants in situations such as sand storms and car bombings. Their illnesses can range from a new onset of asthma to constrictive bronchiolitis (Harrington, Schmidt, Szema, et al., 2017). These veterans could also have been exposed to organic contamination within the sand that could further irritate airways. When providing care to a veteran, it is important to assess exposure to airway irritants, particularly when the patient is complaining of chronic respiratory symptoms.

- **Critical Care icons** identify nursing considerations for the patient who is critically ill.

Pulmonary Edema

Pulmonary edema is an acute event, reflecting a breakdown of physiologic compensatory mechanisms; hence, it is sometimes referred to as acute decompensated heart failure. It can occur following acute MI or as an exacerbation of chronic HF. When the left ventricle begins to fail, blood backs up into the pulmonary circulation, causing pulmonary interstitial edema. This may occur quickly in some patients, a condition sometimes called *flash pulmonary edema*. Pulmonary edema can also develop slowly, especially when it is caused by noncardiac disorders such as kidney injury and other conditions that cause fluid overload. The left ventricle cannot handle the volume overload, and blood volume and pressure build up in the left atrium. The rapid increase in atrial pressure results in an acute increase in pulmonary venous pressure, which produces an increase in hydrostatic pressure that forces fluid out of the pulmonary capillaries and into the interstitial spaces and alveoli (Norris, 2019).

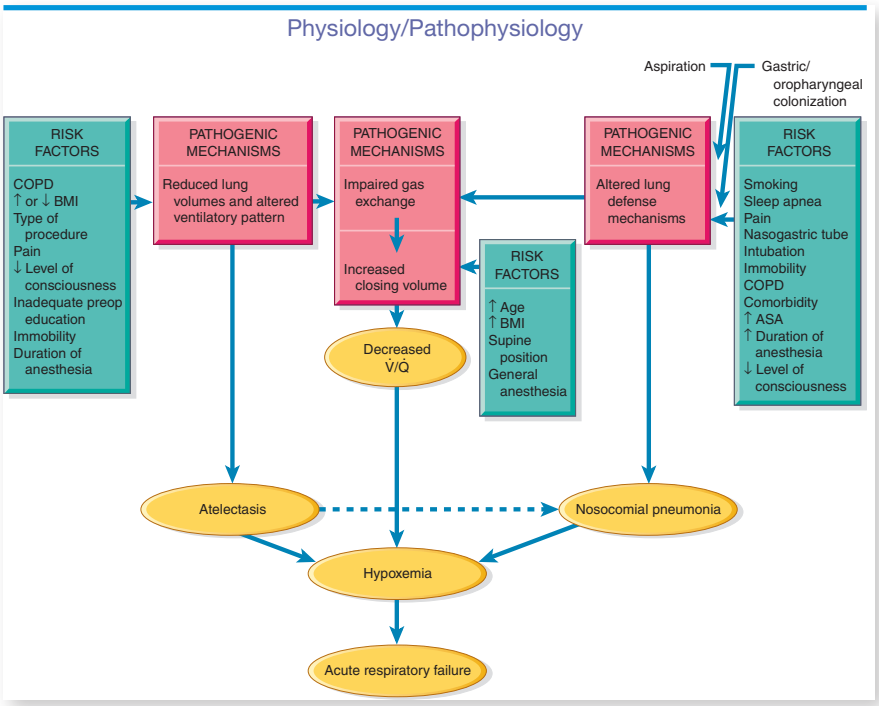
- **Obesity Considerations icons** identify content related to obesity or to the nursing care of patients with obesity.

Obesity contributes to back strain by overtaxing the relatively weak back muscles in the absence of abdominal muscle support. Exercises are less effective and more difficult to perform when the patient is overweight. Weight reduction through diet modification is important to minimize recurrence of back pain. A sound nutritional plan that includes a change in eating habits and low-impact activities is vital. Noting achievement of weight reduction and providing positive reinforcement facilitate adherence. Back

- **Gerontologic Considerations icons** highlight information that pertains specifically to the care of the older adult patient. In the United States, older adults comprise the fastest-growing segment of the population.

Gerontologic Considerations

During the normal aging process, the nervous system undergoes many changes and is more vulnerable to illness. Age-related changes in the nervous system vary in degree and must be distinguished from those due to disease. It is important for clinicians not to attribute abnormality or dysfunction to aging without appropriate investigation. For example, although diminished strength and agility are a normal part of aging, localized weakness can only be attributed to disease.



- **Physiology/Pathophysiology figures** include illustrations and algorithms describing normal physiologic and pathophysiologic processes.

Features to Develop the Nurse as Educator

Health education is a primary responsibility of the nursing profession. Nursing care is directed toward promoting, maintaining, and restoring health; preventing illness; and helping patients and families adapt to the residual effects of illness. Patient education and health promotion are central to all of these nursing activities.

- **Patient Education charts and sections** help the nurse prepare the patient and family for procedures, assist them in understanding the patient's condition, and explain to them how to provide self-care.

Chart 20-5 **PATIENT EDUCATION**
Breathing Exercises

General Instructions

The nurse instructs the patient to:

- Breathe slowly and rhythmically to exhale completely and empty the lungs completely.
- Inhale through the nose to filter, humidify, and warm the air before it enters the lungs.
- Breathe more slowly by prolonging the exhalation time when feeling out of breath.
- Keep the air moist with a humidifier.

Diaphragmatic Breathing

Goal: To use and strengthen the diaphragm during breathing

The nurse instructs the patient to:

- Place one hand on the abdomen (just below the ribs) and the other hand on the middle of the chest to increase the awareness of the position of the diaphragm and its function in breathing.
- Breathe in slowly and deeply through the nose, letting the abdomen protrude as far as possible.
- Breathe out through pursed lips while tightening (contracting) the abdominal muscles.
- Press firmly inward and upward on the abdomen while breathing out.
- Repeat for 1 min; follow with a rest period of 2 min.
- Gradually increase duration up to 5 min, several times a day (before meals and at bedtime).

Pursed-Lip Breathing

Goal: To prolong exhalation and increase airway pressure during expiration, thus reducing the amount of trapped air and the amount of airway resistance

The nurse instructs the patient to:

- Inhale through the nose while slowly counting to 3—the amount of time needed to say "Smell a rose."
- Exhale slowly and evenly against pursed lips while tightening the abdominal muscles. (Pursing the lips increases intratracheal pressure; exhaling through the mouth offers less resistance to expired air.)
- Count to 7 slowly while prolonging expiration through pursed lips—the length of time to say "Blow out the candle."
- While sitting in a chair:
  Fold arms over the abdomen.
  Inhale through the nose while counting to 3 slowly.
  Bend forward and exhale slowly through pursed lips while counting to 7 slowly.
- While walking:
  Inhale while walking two steps.
  Exhale through pursed lips while walking four or five steps.

- **Health Promotion charts** review important points that the nurse should discuss with the patient to prevent common health problems from developing.

Chart 12-2 **HEALTH PROMOTION**

American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Prevention

Individual Choices

Achieve and Maintain a Healthy Weight Throughout Life

- Be as lean as possible throughout life without being underweight.
- Avoid excessive weight gain at all ages. For those who are currently overweight or have obesity, losing even a small amount of weight has health benefits and is a good place to start.
- Engage in regular physical activity and limit consumption of high-calorie foods and beverages as key strategies for maintaining a healthy weight.

Adopt a Physically Active Lifestyle

- Adults should engage in at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity physical activity each week, or an equivalent combination, preferably spread throughout the week.
- Children and adolescents should engage in at least 1 hour of moderate- or vigorous-intensity physical activity each day, with vigorous-intensity activity at least 3 days each week.
- Limit sedentary behavior such as sitting, lying down and watching television, and other forms of screen-based entertainment.
- Doing any intentional physical activity above usual activities, no matter what one's level of activity, can have many health benefits.

Consume a Healthy Diet, with an Emphasis on Plant Sources

- Choose foods and beverages in amounts that help achieve and maintain a healthy weight.
- Limit consumption of processed meat and red meats.
- Eat at least $2\frac{1}{2}$ cups of vegetables and fruits each day.
- Choose whole grains in preference to processed (refined) grains.

If You Drink Alcoholic Beverages, Limit Consumption

- Drink no more than one drink per day for women or two per day for men.

Community Action

Public, private, and community organizations should work collaboratively at national, state, and local levels to implement policy environmental changes that:

- Increase access to affordable, healthy foods in communities, worksites, and schools, and decrease access to and marketing of foods and beverages of low nutritional value, particularly to youth.
- Provide safe, enjoyable, and accessible environments for physical activity in schools and worksites, and for transportation and recreation in communities.

Adapted from American Cancer Society. (2019i). ACS guidelines on nutrition and physical activity for cancer. Retrieved on 9/28/2018 at: Prevention www.cancer.org/healthy/eat-healthy-get-active/acs-guidelines-nutrition-physical-activity-cancer-prevention.html.

- **Home Care Checklists** review points that should be covered as part of home care education prior to discharge from the health care facility.

Chart 41-9 **HOME CARE CHECKLIST**

Managing Ostomy Care

At the completion of education, the patient and/or caregiver will be able to:

- Name the procedure that was performed and identify changes in anatomic structure or function as well as changes in ADLs, IADLs, roles, relationships, and spirituality.
  - Describe the frequency and character of effluent.
- Identify sources for obtaining ostomy care/appliance supplies.
- State the name, dose, side effects, frequency, and schedule for all medications.
- Demonstrate ostomy care, including wound cleansing, irrigation, and appliance changing.
- Describe the importance of assessing and maintaining peristomal skin integrity.
- Identify dietary restrictions (foods that can cause diarrhea and constipation), process for reintroduction of foods, as well as foods that may be encouraged.
- Identify measures to be used to promote fluid and electrolyte balance.
- Describe potential complications and necessary actions to be taken if complications occur.
- Relate how to reach primary provider with questions or complications.
  - Identify how to contact wound-ostomy-continence or home health nurse.
- State time and date of follow-up medical appointments, therapy, and testing.
- Identify sources of support (e.g., friends, relatives, faith community, ostomy support, caregiver support).
- Identify the need for health promotion, disease prevention, and screening activities.

ADLs, activities of daily living; IADLs, instrumental activities of daily living.

Features to Develop the Nurse as Patient Advocate

Nurses advocate for patients by protecting their rights (including the right to health care) and assisting patients and their families in making informed decisions about health care.

- **All new! Ethical Dilemma charts** provide a clinical scenario, discussion points, and questions to help analyze fundamental ethical principles related to the dilemma.

Chart 48-9 ETHICAL DILEMMA
How Can Patient Rights Be Discerned during a Pandemic?

Case Scenario

B.J. is a 74-year-old widow with chronic kidney disease (CKD) managed with HD three times weekly in an outpatient dialysis center. She is admitted to the medical unit where you work as a staff nurse with fluid retention and dyspnea. It is reported that B.J. had been a "no show" at the dialysis center for at least the past week. As part of her therapeutic plan, she is supposed to be dialyzed while in the hospital. As you enter her room to prepare her for transport to the hospital's dialysis center, you find B.J. humming to herself, clapping her hands, and smiling. When you explain to her that she is going to be transported to the dialysis center, she says "Honey, I am not going anywhere. I want to see Jesus. It is my time and I am ready to see the Lord." You have heard from the medical social worker that this is not B.J.'s first admission to the hospital for poor adherence to her outpatient dialysis treatment. During past hospitalizations, her three adult daughters would visit her together and effectively cajole her into receiving dialysis treatments. Reportedly, the daughters have a loving and supportive relationship with each other and their mother. However, there is an outbreak of coronavirus disease 2019 (COVID-19) within your community and the hospital has responded with a no-visitor policy throughout the facility, so B.J.'s daughters may not visit her.

Discussion

The principle of autonomy is considered sacrosanct. Patients have the right to refuse treatments, even if those treatments are life-saving. However, in this particular instance, B.J. could be delirious as a manifestation of her poorly managed CKD. If she is delirious, it may be determined that she lacks the capacity to make her own decisions. Her daughters might be her surrogates and legally responsible to make health care decisions for her. However, her daughters' prohibition to visit her while she is hospitalized hampers their ability to discuss her options with her and gain her assent for treatment.

Analysis

- Describe the ethical principles that are in conflict in this case (see Chapter 1, Chart 1-7). Can the principle of beneficence and wishing to "do good" for B.J. trump her autonomous right to refuse treatment? Can she be forced to undergo dialysis?
- What if it is determined that B.J. lacks the capacity to make informed decisions? On the contrary, what if it is determined that B.J. is not delirious and has the capacity to refuse to be dialyzed? Describe methods that you might employ to engage B.J.'s daughters so that they might be able to communicate with her and with each other as a family unit.
- What resources might be mobilized to be of assistance to B.J., her daughters, and the health care team so that a treatment plan that preserves B.J.'s dignity during this pandemic might be devised?

References

Hulkower, A. (2020). Learning from COVID. *Hastings Center Report*, *50*(3), 16–17.

Resources

See Chapter 1, Chart 1-10 for Steps of an Ethical Analysis and Ethics Resources.

Chart 30-2 NURSING RESEARCH PROFILE
Fatigue and Sleep Disturbances in Adults with Acute Leukemia

Bryant, A., Gosselin, T., Coffman, E., et al. (2018). Symptoms, mobility, and function, and quality of life in adults with acute leukemia during initial hospitalization. *Oncology Nursing Forum, 45*(5), 653–664.

Purpose

Patients newly diagnosed with acute leukemia require hospitalization, typically for 4 to 6 weeks, for managing aggressive induction therapy and its toxicities. These symptoms can greatly impact the patient's quality of life and ability to perform activities of daily living. The purpose of this study was to evaluate global, physical, and mental health symptoms in adults with newly diagnosed acute leukemia.

Design

This was a prospective, longitudinal study with a total of 49 adult participants, including 36 males and 13 females. Data were collected at time of hospitalization (baseline), then weekly until discharge from hospital. Evaluation tools for data included: the Patient-Reported Outcomes Measurement Information System (PROMIS) to determine several self-reported quality-of-life measures such as fatigue, anxiety, depression, pain, sleep disturbances, and global physical and mental health; the Functional Assessment of Cancer Therapy-Leukemia (FACT-Leu) to measure symptom concerns that are leukemic specific; Karnofsky Performance Status Scale (KPS) to measure function; and the Timed UP and Go Test (TUG) to measure physical mobility.

Findings

This study was the largest, to date, to evaluate the symptoms and quality of life of patients newly diagnosed with acute leukemia during hospitalization. All participants had one or more comorbidities, as well as a group mean body mass index of 30.8 (SD = 6.7), indicative of being overweight or having obesity, at time of hospitalization. No significant differences were seen in global mental health, pain, or KPS during hospitalization. There were significant decreases in fatigue ($p < 0.001$), anxiety ($p < 0.001$), depression ($p = 0.004$), and sleep disturbance ($p = 0.005$) from baseline to hospital discharge. Also significant were a decrease in leukemic symptoms ($p < 0.001$), indicating improved leukemic outcomes, which is the goal of therapy.

Nursing Implications

Nurses need to be aware of factors that can impact sleep in patients with cancer, both during and following treatment. As fatigue plays a major role in sleep disturbances, the nurse needs to assess for and develop strategies to address both concerns, especially while the patient is in the hospital. Poor sleep, fatigue, and pain can all contribute to the increased risk for falls, so safety issues should also be addressed with the patient and the patient's family. The nurse should encourage the patient to exercise and have some physical activity as part of the daily routine, to decrease fatigue while enhancing sleep. Additionally, the nurse should have a good understanding of the symptoms common to patients with leukemia and interventions to manage them as they occur.

Features to Develop the Nurse as Researcher

Nurses identify potential research problems and questions to increase nursing knowledge and improve patient care. The use and evaluation of research findings in nursing practice are essential to further the science of nursing.

- **All new and in every chapter! Nursing Research Profiles** identify the implications and applications of nursing research findings for evidence-based nursing practice.

Features to Facilitate Learning

In addition to practice-oriented features, special features have been developed to help readers learn key information.

- **Concept Mastery Alerts** highlight and clarify fundamental nursing concepts to improve understanding of difficult topics, as identified by Misconception Alerts in Lippincott's Adaptive Learning Powered by PrepU, an adaptive quizzing platform.

Concept Mastery Alert

It is important to remember the different types of cholesterol and the role of each as a risk factor for heart disease. HDL is the "good cholesterol," and higher levels are better; LDL is the "bad cholesterol," and lower levels are better.

- **Unfolding Patient Stories**, written by the National League for Nursing, are an engaging way to begin meaningful conversations in the classroom. These vignettes, which appear throughout the text near related content, feature patients from Wolters Kluwer's vSim for Nursing | Medical-Surgical (co-developed by Laerdal Medical) and DocuCare products; however, each Unfolding Patient Story in the book stands alone, not requiring purchase of these products. For your convenience, a list of these case studies, along with their location in the book, appears in the "Case Studies in This Book" section later in this front matter.
- Interactive learning tools available online enrich learning and are identified with icons in the text:

  Concepts in Action Animations bring physiologic and pathophysiologic concepts to life.

  Practice & Learn Case Studies present case scenarios and offer interactive exercises and questions to help you apply what you have learned.

  Watch & Learn Video Clips reinforce skills from the textbook and appeal to visual and auditory learners.

- **All new! Critical Thinking Exercises** foster critical thinking and challenge you to apply textbook knowledge to clinical scenarios. Evidence-based practice (EBP) questions encourage you to apply best evidence from research findings to nursing interventions. Prioritization (PQ) questions ask you to consider the priorities for nursing care for specific patients and conditions. Interprofessional collaboration (IPC) exercises challenge you to identify the roles and responsibilities of the professional nurse and of interprofessional colleagues in collaboratively delivering quality patient-centered care.

Unfolding Patient Stories: Doris Bowman • Part 2

Recall from Chapter 12 **Doris Bowman**, who is undergoing a total abdominal hysterectomy with bilateral salpingo-oophorectomy. What are potential postoperative complications that the nurse should consider? What assessments and interventions are done by the nurse to monitor for early detection or to prevent these complications? Describe the discharge education provided by the nurse on self-care monitoring required of the patient at home and what should be reported to the health care provider.

Care for Doris and other patients in a realistic virtual environment: ***vSim** for Nursing* (**thepoint.lww.com/vSimMedicalSurgical**). Practice documenting these patients' care in DocuCare (**thepoint.lww.com/DocuCareEHR**).

CRITICAL THINKING EXERCISES

1 ipc You are caring for a 53-year-old woman in the outpatient clinic where you work; she is newly diagnosed with urinary incontinence. What type of referrals might be appropriate for this patient? What members of the interprofessional health care team do you anticipate as being integral to the care of this patient?

2 ebp You notice an increase in the number of CAUTIs among patients on the medical-surgical unit where you work. What are the evidence-based management techniques used in CAUTI prevention? Identify the criteria used to evaluate the strength of the evidence for these practices. How will you individualize these techniques for your unit?

3 pq A 65-year-old man is admitted to the medical-surgical nursing unit where you work with bladder cancer. He is scheduled for a radical cystectomy with an orthotopic neobladder reconstruction. Identify the priorities, approach, and techniques you would use to provide care for this patient in the preoperative phase of care. How will your priorities, approach, and techniques differ in the postoperative phase of care?

- **References** cited are listed at the end of each chapter and include updated, current sources.
- **Resources** lists at the end of each chapter include sources of additional information, Web sites, agencies, and patient education materials.

REFERENCES

*Asterisk indicates nursing research.

Books

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Atanelov, Z., & Rebstock, S. E. (2020) Nasopharyngeal airway. *StatPearls [Internet]*. Treasure Island, FL: StatPearls Publishing. Retrieved on 4/6/2020 at: www.ncbi.nlm.nih.gov/books/NBK513220/

Emergency Nurses Association (ENA). (2017). *Emergency nursing scope and standards of practice* (2nd ed.). Des Plaines, IL: Author.

Emergency Nurses Association (ENA). (2020a). *Sheehy's manual of emergency care* (7th ed.). St. Louis, MO: Mosby.

Holleran, R., Wolfe, A., & Frakes, M. (2018). *Patient transport: Principles & practice* (5th ed.). St Louis, MO: Elsevier.

Resources

American Association of Poison Control Centers (AAPCC), www.aapcc.org

American College of Emergency Physicians (ACEP), www.acep.org

American College of Surgeons (ACS), Injury Prevention and Control, www.facs.org/quality-programs/trauma/ipc

American Heart Association, www.heart.org

American Trauma Society (ATS), www.amtrauma.org/default.aspx

American Red Cross, Prepare for Emergencies, www.redcross.org/get-help/prepare-for-emergencies/types-of-emergencies

Divers Alert Network (DAN), www.diversalertnetwork.org

Emergency Nurses Association (ENA), www.ena.org

National Capital Poison, Poison Control Center, poison.org

National Center on Elder Abuse (NCEA), ncea.acl.gov

National Center for Health Statistics (NCHS), cdc.gov/nchs/

National Human Trafficking Hotline, www.humantraffickinghotline.org

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Plan of Nursing Care

Procedural Guidelines (available on thePoint)

Risk Factors

25 Management of Patients with Complications from Heart Disease

LEARNING OUTCOMES

On completion of this chapter, the learner will be able to:

1. Recognize the etiology, pathophysiology, and clinical manifestations of the different classifications of heart failure.
2. Describe the medical management, including recommended pharmacologic treatments, for patients with heart failure.
3. Use the nursing process as a framework for care of the patient with heart failure.
4. Identify additional heart disease disorders and medical and nursing management of patients with complications from heart disease.

NURSING CONCEPT

Perfusion

GLOSSARY

anuria: urine output of less than 50 mL/24 h
ascites: an accumulation of serous fluid in the peritoneal cavity
cardiac resynchronization therapy (CRT): a treatment for heart failure in which a device paces both ventricles to synchronize contractions
congestive heart failure (CHF): a fluid overload condition (congestion) associated with heart failure
diastolic heart failure: the inability of the left ventricle of the heart to fill and pump sufficiently; term used to define a type of heart failure (*synonym:* Heart Failure with preserved Ejection Fraction [HFpEF])
ejection fraction (EF): percentage of blood volume in the ventricles at the end of diastole that is ejected during systole; a measurement of contractility
heart failure (HF): a clinical syndrome resulting from structural or functional cardiac disorders that impair the ability of a ventricle to fill or eject blood
Heart Failure with midrange Ejection Fraction (HFmrEF): clinical heart failure syndrome with left ventricular ejection fraction that is 40% to 49%
Heart Failure with preserved Ejection Fraction (HFpEF): clinical heart failure syndrome with left ventricular ejection fraction greater than or equal to 50% (*synonym:* diastolic heart failure)
Heart Failure with reduced Ejection Fraction (HFrEF): clinical heart failure syndrome with left ventricular ejection fraction less than or equal to 40% (*synonym:* systolic heart failure)
left-sided heart failure: inability of the left ventricle to fill or eject sufficient blood into the systemic circulation (*synonym:* left ventricular failure)
oliguria: diminished urine output; less than 0.5 mL/kg/h over at least 6 hours, or less than 400 mL in 24 hours
orthopnea: shortness of breath when lying flat
paroxysmal nocturnal dyspnea (PND): shortness of breath that occurs suddenly during sleep
pericardiocentesis: procedure that involves aspiration of fluid from the pericardial sac
pericardiotomy: surgically created opening of the pericardium
pulmonary edema: pathologic accumulation of fluid in the interstitial spaces and alveoli of the lungs causing severe respiratory distress
pulseless electrical activity (PEA): condition in which electrical activity is present on an electrocardiogram, but there is not a physiologically adequate pulse or blood pressure
pulsus paradoxus: systolic blood pressure that is more than 10 mm Hg lower during inhalation than during exhalation; difference is normally less than 10 mm Hg
right-sided heart failure: inability of the right ventricle to fill or eject sufficient blood into the pulmonary circulation (*synonym:* right ventricular failure)
systolic heart failure: inability of the heart to pump sufficiently because of an alteration in the ability of the heart to contract; term used to describe a type of heart failure (*synonym:* Heart Failure with reduced Ejection Fraction [HFrEF])

Cardiovascular disease is the leading cause of death in the United States (Centers for Disease Control and Prevention [CDC], 2017). Because of advancements in diagnostic and screening procedures, greater recognition of the importance of diligent self-care practices, and new discoveries in pharmacotherapies, it is now possible for a person diagnosed with heart disease to continue to live with a high quality of life years after being diagnosed. Despite this progress, heart disease remains a chronic and often progressive condition, associated with serious comorbidities, such as heart failure (Benjamin, Muntner, Alonso, et al., 2019). This chapter presents the complications most often associated with heart disease, including the medical management and nursing processes for managing patients with complications of cardiovascular disease.

HEART FAILURE

Heart failure (HF) is a clinical syndrome resulting from structural or functional cardiac disorders so that the heart is unable to pump enough blood to meet the body's metabolic demands or needs (American Heart Association [AHA], 2019a). The term *heart failure* indicates myocardial disease in which impaired contraction of the heart (systolic dysfunction) or filling of the heart (diastolic dysfunction) may cause pulmonary or systemic congestion. Some cases of HF are reversible, depending on the cause. Most often, HF is a chronic, progressive condition that is managed with lifestyle changes and medications to prevent episodes of acute decompensated heart failure. These episodes are characterized by increased symptoms of respiratory distress, decreased cardiac output (CO), and poor perfusion. These episodes are also associated with increased hospitalizations, increased health care costs, and decreased quality of life (Benjamin et al., 2019).

Approximately six million people in the United States have HF, and 870,000 new cases are diagnosed each year (AHA, 2019a). As more people live longer with chronic heart diseases, HF has become an epidemic that challenges the country's health care resources. HF is the most common reason for hospitalization of people older than 65 years and is the second most common reason for visits to a provider's office. Emergency department (ED) visits and hospital readmissions for this disorder are very common, despite efforts to prevent rehospitalizations. Over 20% of patients discharged after treatment for HF are readmitted to the hospital within 30 days, and nearly 50% are readmitted to the hospital within 6 months (O'Connor, 2017). The estimated economic burden caused by HF in the United States is more than $30 billion annually in direct and indirect costs and is expected to continue to increase over time (CDC, 2017).

HF is more prevalent among African Americans and Hispanics than among Caucasians. The risk for having HF increases with advancing age. For adults over 60 years of age, HF is more prevalent among men than women (Benjamin et al., 2019). As typical for other major cardiovascular diseases and disorders, cigarette smoking, obesity, poorly managed diabetes, and metabolic syndrome are all risks for HF (Benjamin et al., 2019). The onset of HF is typically a morbid consequence of another disease or disorder, including coronary artery disease (CAD), hypertension, cardiomyopathy, valvular disorders, and renal dysfunction with volume overload (McCance, Huether, Brashers, et al., 2019).

Atherosclerosis of the coronary arteries is a primary cause of HF, and CAD is found in the majority of patients with HF. Ischemia causes myocardial dysfunction because it deprives heart cells of oxygen and causes cellular damage. Myocardial infarction (MI) causes focal heart muscle necrosis, the death of myocardial cells, and a loss of contractility; the extent of the infarction correlates with the severity of HF. Revascularization of the coronary artery by a percutaneous coronary intervention (PCI) or by coronary artery bypass surgery (coronary artery bypass graft [CABG]) may improve myocardial oxygenation and ventricular function and prevent more extensive myocardial necrosis that can lead to HF (see Chapter 23).

Systemic or pulmonary hypertension increases afterload (resistance to ejection), increasing the cardiac workload and leading to the hypertrophy of myocardial muscle fibers. This can be considered a compensatory mechanism because it initially increases contractility. However, sustained hypertension eventually leads to changes that impair the heart's ability to fill properly during diastole, and the hypertrophied ventricles may dilate and fail (Norris, 2019; Yancy, Jessup, Bozkurt, et al., 2017).

Cardiomyopathy is a disease of the myocardium. The various types of cardiomyopathy lead to HF and arrhythmias. Dilated cardiomyopathy (DCM), the most common type of cardiomyopathy, causes diffuse myocyte necrosis and fibrosis, and commonly leads to progressive HF (Norris, 2019). DCM can be idiopathic (unknown cause), or it can result from an inflammatory process, such as myocarditis, or from a cytotoxic agent, such as alcohol or certain antineoplastic drugs. Usually, HF due to cardiomyopathy is chronic and progressive. However, cardiomyopathy and HF may resolve following removal of the causative agent. Genetic testing may be recommended for idiopathic cardiomyopathy (van der Meer, Gaggin, & Dec, 2019) (see Chapter 24).

Valvular heart disease is also a cause of HF. The valves ensure that blood flows in one direction. With valvular dysfunction, it becomes increasingly difficult for blood to move forward, increasing pressure within the heart and increasing cardiac workload, leading to HF (see Chapter 24).

Several systemic conditions, including progressive kidney failure, contribute to the development and severity of HF. Nearly 30% of patients with chronic HF also have chronic kidney disease (Benjamin et al., 2019). In addition, cardiac arrhythmias such as atrial fibrillation may either cause or result from HF; in both instances, the altered electrical stimulation impairs myocardial contraction and decreases the overall efficiency of myocardial function. Other factors, such as hypoxia, acidosis, and electrolyte abnormalities, can worsen myocardial function (Yancy et al., 2017).

Pathophysiology

Regardless of the etiology, the pathophysiology of HF results in similar changes and clinical manifestations. Significant myocardial dysfunction usually occurs before the patient experiences signs and symptoms of HF such as shortness of breath, edema, or fatigue.

As HF develops, the body activates neurohormonal compensatory mechanisms. These mechanisms represent the

body's attempt to cope with the HF and are responsible for the signs and symptoms that develop (Norris, 2019). Understanding these mechanisms is important because the treatment for HF is aimed at correcting them and relieving symptoms.

The most common type of HF is systolic HF, also called Heart Failure with reduced Ejection Fraction (HFrEF; see later discussion in Assessment and Diagnostic Findings). **Systolic heart failure** results in decreased blood ejected from the ventricle. The decreased blood flow is sensed by baroreceptors in the aortic and carotid bodies, and the sympathetic nervous system is then stimulated to release epinephrine and norepinephrine (Fig. 25-1). The purpose of this initial response is to increase heart rate and contractility and support the failing myocardium, but the continued response has multiple negative effects. Sympathetic stimulation causes vasoconstriction in the skin, gastrointestinal tract, and kidneys. A decrease in renal perfusion due to low CO and vasoconstriction then causes the release of renin by the kidneys. Renin converts the plasma protein angiotensinogen to angiotensin I, which then circulates to the lungs. Angiotensin-converting enzyme (ACE) in the lumen of pulmonary blood vessels converts angiotensin I to angiotensin II, a potent vasoconstrictor, which then increases the blood pressure and afterload. Angiotensin II also stimulates the release of aldosterone from the adrenal cortex, resulting in sodium and fluid retention by the renal tubules and an increase in blood volume. These mechanisms lead to the fluid volume overload commonly seen in HF. Angiotensin, aldosterone, and other neurohormones (e.g., endothelin) lead to an increase in preload and afterload, which increases stress on the ventricular wall, causing an increase in cardiac workload. A counterregulatory mechanism is attempted through the release of natriuretic peptides. Atrial natriuretic peptide (ANP) and B-type natriuretic peptide (BNP; brain type) are released from the overdistended cardiac chambers. These substances promote vasodilation and diuresis. However, their effect is usually not strong enough to overcome the negative effects of the other mechanisms (Norris, 2019).

Physiology/Pathophysiology

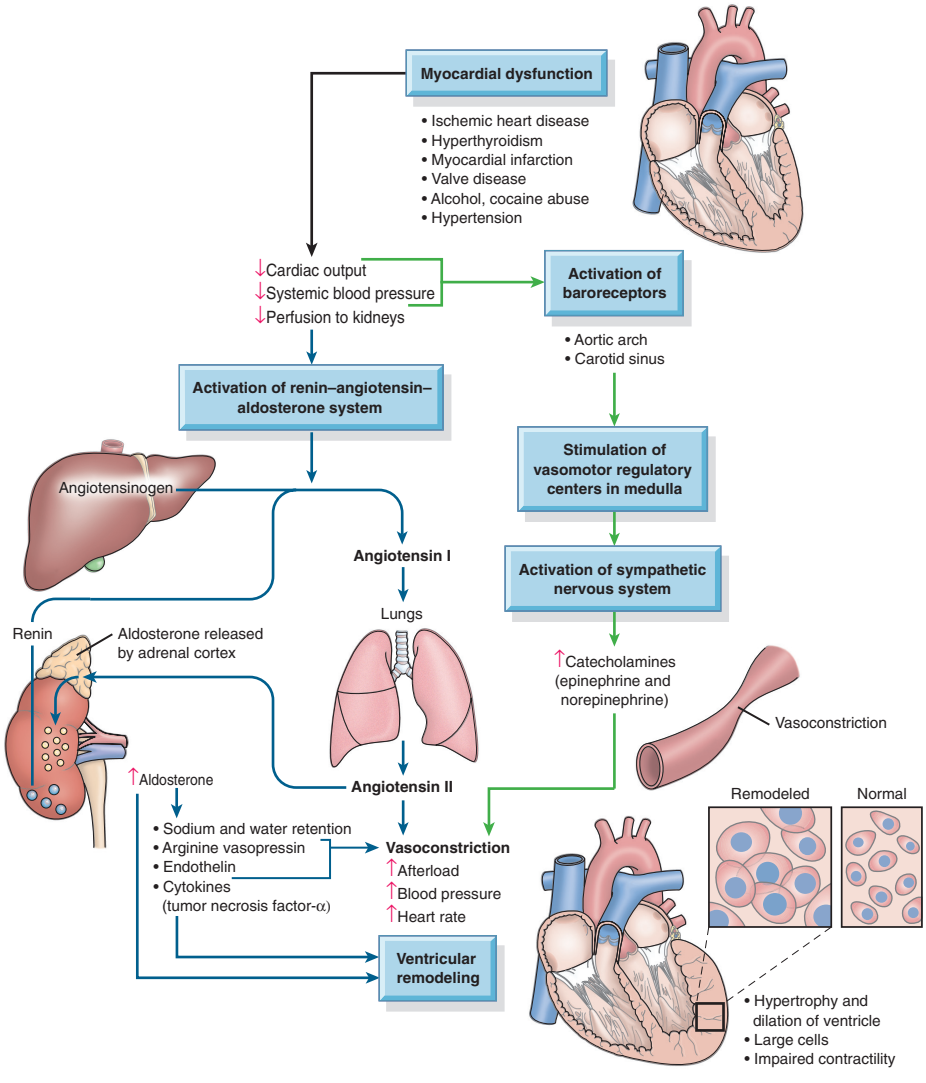

Figure 25-1 • The pathophysiology of heart failure. A decrease in cardiac output activates multiple neurohormonal mechanisms that ultimately result in the signs and symptoms of heart failure.

As the heart's workload increases, contractility of the myocardial muscle fibers decreases. Decreased contractility results in an increase in end-diastolic blood volume in the ventricle, stretching the myocardial muscle fibers and increasing the size of the ventricle (ventricular dilation). The heart compensates for the increased workload by increasing the thickness of the heart muscle (ventricular hypertrophy). Hypertrophy results in abnormal changes in the structure and function of myocardial cells, a process known as ventricular remodeling. Under the influence of neurohormones (e.g., angiotensin II), enlarged myocardial cells become dysfunctional and die early (a process called *apoptosis*), leaving the other, functional myocardial cells struggling to maintain CO.

As cardiac cells die and the heart muscle becomes fibrotic, **diastolic heart failure**, also called Heart Failure with preserved Ejection Fraction (HFpEF) (see later discussion in Assessment and Diagnostic Findings), can develop, leading to further dysfunction. A stiff ventricle resists filling, and less blood in the ventricles causes a further decrease in CO. All of these compensatory mechanisms of HF have been referred to as the "vicious cycle of heart failure" because low CO leads to multiple mechanisms that make the heart work harder, worsening the HF.

Clinical Manifestations

Many clinical manifestations are associated with HF (Chart 25-1). However, the cardinal manifestations of HF are dyspnea; fatigue, which may limit exercise tolerance; and fluid retention, which may lead to congestion, evidenced by pulmonary and peripheral edema (Yancy, Jessup, Bozkurt, et al., 2013). The signs and symptoms of HF are related to the ventricle that is most affected. **Left-sided heart failure**, also referred to as left ventricular failure because of the inability of the left ventricle to fill or eject sufficient blood into the systemic circulation, causes different manifestations than **right-sided heart failure**, also referred to as right ventricular failure because of the inability of the right ventricle to fill or eject sufficient blood into the pulmonary circulation. In chronic HF, particularly congestive heart failure, patients may have signs and symptoms of both left- and right-sided heart failure. The patient with pulmonary edema manifests signs and symptoms of acute decompensation, warranting expeditious treatment.

Left-Sided Heart Failure

Pulmonary congestion occurs when the left ventricle cannot effectively pump blood out of the ventricle into the aorta and the systemic circulation. The increased left ventricular end-diastolic blood volume increases the left ventricular end-diastolic pressure, which decreases blood flow from the left atrium into the left ventricle during diastole. The blood volume and pressure build up in the left atrium, decreasing flow through the pulmonary veins into the left atrium. Pulmonary venous blood volume and pressure increase in the lungs, forcing fluid from the pulmonary capillaries into the pulmonary tissues and alveoli, causing pulmonary interstitial edema and impaired gas exchange. The clinical manifestations of pulmonary congestion include dyspnea, cough, pulmonary crackles, and low oxygen saturation levels. An extra heart sound, the S_3, or "ventricular gallop," may be detected on auscultation.

Chart 25-1 ASSESSMENT
Heart Failure

Be alert for the following signs and symptoms:

Congestion

- Dyspnea
- Orthopnea
- Paroxysmal nocturnal dyspnea
- Cough (recumbent or exertional)
- Pulmonary crackles that do not clear with cough
- Weight gain (rapid)
- Dependent edema
- Abdominal bloating or discomfort
- Ascites
- Jugular venous distention
- Sleep disturbance (anxiety or air hunger)
- Fatigue

Poor Perfusion/Low Cardiac Output

- Decreased exercise tolerance
- Muscle wasting or weakness
- Anorexia or nausea
- Unexplained weight loss
- Lightheadedness or dizziness
- Unexplained confusion or altered mental status
- Resting tachycardia
- Daytime oliguria with recumbent nocturia
- Cool or vasoconstricted extremities
- Pallor or cyanosis

Adapted from Colucci, W. S., & Dunlay, S. M. (2017). Clinical manifestations and diagnosis of advanced heart failure. *UpToDate*. Retrieved on 12/6/2019 at: www.uptodate.com/contents/clinical-manifestations-and-diagnosis-of-advanced-heart-failure; Dumitru, I. (2018). Heart failure. *Medscape*. Retrieved on 12/6/2019 at: www.emedicine.medscape.com/article/163062-overview

It is caused by abnormal ventricular filling (Colucci & Dunlay, 2017; Dumitru, 2018).

Dyspnea, or shortness of breath, may be precipitated by minimal to moderate activity (dyspnea on exertion [DOE]), yet dyspnea may also occur at rest. The patient may report **orthopnea**, difficulty breathing when lying flat. Patients with orthopnea may use multiple pillows to prop themselves up in bed, or they may sleep sitting up or in a high, reclined position. Some patients have sudden attacks of dyspnea at night, a condition known as **paroxysmal nocturnal dyspnea (PND)**. Fluid accumulating in the dependent extremities during the day may be reabsorbed into the circulating blood volume when the patient lies down. Because the impaired left ventricle cannot eject the increased circulating blood volume, the pressure in the pulmonary circulation increases, shifting fluid into the alveoli. The fluid-filled alveoli cannot exchange oxygen and carbon dioxide. Without sufficient oxygen, the patient experiences dyspnea and has difficulty sleeping (Colucci & Dunlay, 2017; Dumitru, 2018).

The cough associated with left ventricular failure is initially dry and nonproductive. Most often, patients complain of a dry hacking cough that may be mislabeled as asthma or chronic obstructive pulmonary disease (COPD). Over time, the cough may begin to accumulate secretions. Large quantities of frothy sputum, sometimes pink or tan, may be

produced, indicating acute decompensated HF and pulmonary edema (Colucci & Dunlay, 2017; Dumitru, 2018).

Adventitious breath sounds may be heard in various areas of the lungs. Usually, bibasilar crackles that do not clear with coughing are detected in the early phase of left ventricular failure. As the failure worsens and pulmonary congestion increases, crackles may be auscultated throughout the lung fields. At this point, oxygen saturation may decrease.

In addition to pulmonary manifestations, the decreased amount of blood ejected from the left ventricle can lead to inadequate tissue perfusion. The diminished CO has widespread manifestations because not enough blood reaches all of the tissues and organs (low perfusion) to provide the necessary oxygen. The decrease in stroke volume (SV) can also stimulate the sympathetic nervous system to release catecholamines, which further impedes perfusion to many organs, including the kidneys.

As reduced CO and catecholamines decrease blood flow to the kidneys, urine output drops. Renal perfusion pressure falls, and the renin–angiotensin–aldosterone system is stimulated to increase blood pressure and intravascular volume. While the patient sleeps, the cardiac workload decreases, improving renal perfusion. This may cause **nocturia** (i.e., frequent urination at night) (Colucci & Dunlay, 2017; Dumitru, 2018).

As HF progresses, decreased output from the left ventricle may cause other symptoms. Decreased gastrointestinal perfusion causes altered digestion. Decreased brain perfusion causes dizziness, lightheadedness, confusion, restlessness, and anxiety due to decreased oxygenation and blood flow. As anxiety increases, so does dyspnea, increasing anxiety and creating a vicious cycle. Stimulation of the sympathetic system also causes the peripheral blood vessels to constrict, so the skin appears pale or ashen and feels cool and clammy.

A decrease in SV causes the sympathetic nervous system to increase the heart rate (tachycardia), often causing the patient to complain of palpitations. The peripheral pulses become weak. Without adequate CO, the body cannot respond to increased energy demands, and the patient becomes easily fatigued and has decreased activity tolerance. Fatigue also results from the increased energy expended in breathing and the insomnia that results from respiratory distress, coughing, and nocturia (Colucci & Dunlay, 2017; Dumitru, 2018).

Right-Sided Heart Failure

When the right ventricle fails, congestion in the peripheral tissues and the viscera predominates. This occurs because the right side of the heart cannot eject blood effectively and cannot accommodate all of the blood that normally returns to it from the venous circulation. Increased venous pressure leads to jugular venous distention (JVD) and increased capillary hydrostatic pressure throughout the venous system. Systemic clinical manifestations include dependent edema (edema of the lower extremities), **hepatomegaly** (enlargement of the liver), **ascites** (accumulation of fluid in the peritoneal cavity), and weight gain due to retention of fluid. Edema usually affects the feet and ankles and worsens when the patient stands or sits for a long period. The edema may decrease when the patient elevates the legs. Edema can gradually progress up the legs and thighs and eventually into the external genitalia and lower trunk. Ascites is evidenced by increased abdominal girth and may accompany lower body edema or may be the only edema present. Sacral edema is common in patients who are on bed rest, because the sacral area is dependent. Pitting edema, in which indentations in the skin remain after even slight compression with the fingertips (Fig. 25-2), is generally obvious after retention of at least 4.5 kg (10 lb) of fluid (4.5 L).

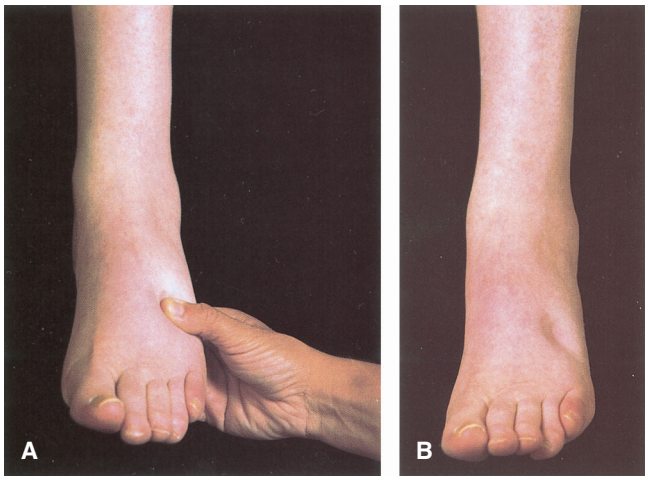

Figure 25-2 • Example of pitting edema. **A.** The nurse applies pressure to an area near the ankle. **B.** When the pressure is released, an indentation remains in the edematous tissue. Reprinted with permission from Bickley, L. S. (2017). *Bates' guide to physical examination and history taking* (12th ed.). Philadelphia, PA: Lippincott Williams & Wilkins.

Hepatomegaly and tenderness in the right upper quadrant of the abdomen result from venous engorgement of the liver. The increased pressure may interfere with the liver's ability to function (secondary liver dysfunction). As hepatic dysfunction progresses, increased pressure within the portal vessels may force fluid into the abdominal cavity, causing ascites. Ascites may increase pressure on the stomach and intestines and cause gastrointestinal distress. Hepatomegaly may also increase pressure on the diaphragm, causing respiratory distress.

Anorexia (loss of appetite), nausea, or abdominal pain may result from the venous engorgement and venous stasis within the abdominal organs. The generalized weakness that accompanies right-sided HF results from reduced CO and impaired circulation (Colucci & Dunlay, 2017; Dumitru, 2018).

Congestive Heart Failure

Right-sided heart failure can sometimes occur as a result of left-sided failure. The failure of these dual mechanisms is sometimes referred to as **congestive heart failure**. When the left ventricle fails, increased fluid pressure is transferred back through the lungs, leading to damage of the right side of the heart. When the right side loses pumping power, the blood backs up in the body's venous system. This may cause swelling or congestion in the legs, ankles, and swelling within the abdomen such as the GI tract and liver. Increased venous pressure may also lead to JVD and increased capillary hydrostatic pressure throughout the venous system. Edema may be present in the periphery as well as within the pulmonary

vascular bed. Without appropriate treatment, this may progress to pulmonary edema.

Pulmonary Edema

Pulmonary edema is an acute event, reflecting a breakdown of physiologic compensatory mechanisms; hence, it is sometimes referred to as acute decompensated heart failure. It can occur following acute MI or as an exacerbation of chronic HF. When the left ventricle begins to fail, blood backs up into the pulmonary circulation, causing pulmonary interstitial edema. This may occur quickly in some patients, a condition sometimes called *flash pulmonary edema*. Pulmonary edema can also develop slowly, especially when it is caused by noncardiac disorders such as kidney injury and other conditions that cause fluid overload. The left ventricle cannot handle the volume overload, and blood volume and pressure build up in the left atrium. The rapid increase in atrial pressure results in an acute increase in pulmonary venous pressure, which produces an increase in hydrostatic pressure that forces fluid out of the pulmonary capillaries and into the interstitial spaces and alveoli (Norris, 2019).

As a result of decreased cerebral oxygenation, the patient may become increasingly restless and anxious. Along with a sudden onset of breathlessness and a sense of suffocation, the patient may be tachypneic with low oxygen saturation levels. The skin and mucous membranes may be pale to cyanotic, and the hands may be cool and clammy. Tachycardia and JVD may be present. Incessant coughing may occur, producing increasing quantities of foamy sputum. The patient may become progressively confused. The situation demands emergent action before oxygenation and perfusion levels become critical.

Assessment and Diagnostic Findings

For many years, the severity of HF was classified solely according to the patient's symptoms, using the New York Heart Association (NYHA) classification of HF. This classification system, which is still in widespread use, is described in Table 25-1. The American College of Cardiology and the American Heart Association (ACC/AHA) have developed another HF classification system (Yancy et al., 2013). This system, described in Table 25-2, takes into consideration the natural history and progressive nature of HF. The ACC/AHA periodically issues evidence-based guidelines for patients with HF or at high-risk of having HF, using this classification system as a framework for treatment (Yancy et al., 2013; Yancy, Jessup, Bozkurt, et al., 2016; Yancy et al., 2017).

HF may go undetected until the patient presents with signs and symptoms of pulmonary and peripheral edema. Some of the physical signs that suggest HF may also occur with other diseases, such as kidney injury and COPD; therefore, diagnostic testing is essential to confirm a diagnosis of HF.

Assessment of ventricular function is an essential part of the initial diagnostic workup. An echocardiogram is performed to determine the ejection fraction (EF), identify anatomic features such as structural abnormalities and valve malfunction, and confirm the diagnosis of HF. The **ejection fraction** is a measure of ventricular contractility; it is the percentage of the end-diastolic blood volume that is ejected with each heartbeat. An expected EF is 55% to 65% of the ventricular volume; the ventricle does not completely empty between contractions (Wiegand, 2017).

TABLE 25-1 New York Heart Association (NYHA) Classification of Heart Failure

Classification	Signs and Symptoms
I	No limitation of physical activity Ordinary activity does not cause undue fatigue, palpitation, or dyspnea.
II	Slight limitation of physical activity Comfortable at rest, but ordinary physical activity causes fatigue, palpitation, or dyspnea.
III	Marked limitation of physical activity Comfortable at rest, but less than ordinary activity causes fatigue, palpitation, or dyspnea.
IV	Unable to carry out any physical activity without discomfort Symptoms of cardiac insufficiency at rest If any physical activity is undertaken, discomfort is increased.

Adapted from Yancy, C. W., Jessup, M., Bozkurt, B., et al. (2013). 2013 ACCF/AHA Guideline for the management of heart failure. A report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. *Circulation*, *128*(16), e240–e327.

There are two recognized main types of left-sided HF, with a third, emerging category. In **heart failure with reduced ejection fraction (HFrEF)**, or systolic heart failure, the left ventricle loses the ability to contract effectively, manifesting as EFs of less than 40%, reflecting decreased CO and pump failure (Yancy et al., 2017).

Heart failure with preserved ejection fraction (HFpEF), or diastolic heart failure, is diagnosed when the left ventricular function measures greater than or equal to 50%, yet the ventricle loses its ability to relax due to myocardial stiffness. Because of the noncompliance of the ventricular wall, the chamber is unable to fill at normal capacity during the relaxation phase of diastole (Yancy et al., 2017).

Heart failure with midrange ejection fraction (HFmrEF) is a third and emerging classification category, with EFs typically between 40% and 49% (van der Meer et al., 2019).

Diagnosing a patient with HFpEF is more challenging than diagnosing a patient with HFrEF, because the diagnosis of HFpEF is a *diagnosis of exclusion*. That is, it is made by excluding other potential noncardiac causes suggestive of HF. The incidence of HFpEF is increasing and is becoming more commonplace among older adult women with a history of hypertension; indeed, hypertension is the most common underlying cause of HFpEF. Comorbid conditions such as obesity, CAD, diabetes, atrial fibrillation, and hyperlipidemia are also common in patients with HFpEF (Yancy et al., 2013).

In addition to the echocardiogram, a chest x-ray and a 12-lead electrocardiogram (ECG) are obtained to assist in the diagnosis. Laboratory studies usually performed during the initial workup include serum electrolytes, blood urea nitrogen (BUN), creatinine, liver function tests, thyroid-stimulating hormone, complete blood count (CBC), BNP, and routine urinalysis. The results of these laboratory studies assist in determining the underlying cause and can also

TABLE 25-2 American College of Cardiology and American Heart Association (ACC/AHA) Classification of Heart Failure

Classification	Criteria	Patient Characteristics	Treatment Recommendations for Appropriate Patients
Stage A	Patients at high risk for developing left ventricular dysfunction but without structural heart disease or symptoms of HF	Hypertension Atherosclerotic disease Diabetes Metabolic syndrome	Heart healthy lifestyle Risk factor control of hypertension, lipids, diabetes, obesity
Stage B	Patients with left ventricular dysfunction or structural heart disease who have not developed symptoms of HF	History of myocardial infarction Left ventricular hypertrophy Low ejection fraction	Implement stage A recommendations, plus: • ACE inhibitor, or ARB, or ARNI for low EF or history of MI • Beta-blocker • Statin
Stage C	Patients with left ventricular dysfunction or structural heart disease with current or prior symptoms of heart disease	Shortness of breath Fatigue Decreased exercise tolerance	Implement stage A and B recommendations, plus: • Diuretics • Aldosterone antagonist • Sodium restriction • Implantable defibrillator • Cardiac resynchronization therapy
Stage D	Patients with refractory end-stage HF requiring specialized interventions	Symptoms despite maximal medical therapy Recurrent hospitalizations	Implement stage A, B, and C recommendations, plus: • Fluid restriction • End-of-life care • Extraordinary measures: • Inotropes • Cardiac transplantation • Mechanical support

ACE, angiotensin-converting enzyme; ARB, angiotensin receptor blocker; ARNI, angiotensin receptor-neprilysin inhibitor, EF, ejection fraction; HF, heart failure; MI, myocardial infarction.

Adapted from Yancy, C. W., Jessup, M., Bozkurt, B., et al. (2013). 2013 ACCF/AHA guideline for the diagnosis and management of heart failure: A report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. *Circulation*, *128*(16), e240–e327; Yancy, C. W., Jessup, M., Bozkurt, B., et al. (2016). ACC/AHA/HFSA focused update on new pharmacological therapy for heart failure: An update of the 2013 ACCF/AHA guideline for the management of heart failure: A report of the American College of Cardiology Foundation/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Failure Society of America. *Circulation*, *134*(13), e282–e293.

be used to establish a baseline to assess effects of treatment. The BNP level is a key diagnostic indicator of HF; high levels are a sign of high cardiac filling pressure and can aid in both the diagnosis and management of HF; in particular, rising levels may suggest an acute exacerbation of HF (Yancy et al., 2013). BNP levels are best used for diagnostic purposes when there is a baseline measurement and a measurement obtained at the time of treatment (e.g., hospital discharge) to help in determining a posttreatment prognosis (Yancy et al., 2017).

Medical Management

The prognosis for patients with HF has improved with the use of evidence-based protocols for patient management. Specific interventions are based on the stage of HF (Yancy et al., 2013; Yancy et al., 2016; Yancy et al., 2017). The management goals of HF include the following (Cyrille & Patel, 2017):

- Improvement of cardiac function with optimal pharmacologic management
- Reduction of symptoms and improvement of functional status
- Stabilization of patient condition and lowering of the risk of hospitalization
- Delay of the progression of HF and extension of life expectancy
- Promotion of a lifestyle conducive to cardiac health

Treatment options vary according to the severity of the patient's condition, comorbidities, and cause of the HF, and may include oral and intravenous (IV) medications, lifestyle modifications, supplemental oxygen, and surgical interventions, including implantation of cardiac devices, and cardiac transplantation (see Chapter 24).

Managing the patient with HF begins with providing comprehensive education and counseling to the patient and family. The patient and family must understand the nature of HF and the importance of their participation in the treatment regimen, including side and adverse effects of pharmacologic therapies. Lifestyle recommendations include restriction of dietary sodium; avoidance of smoking, including secondhand smoke; avoidance of excessive fluid and alcohol intake; weight reduction when indicated; and regular exercise. The patient must also know how to recognize signs and symptoms that need to be reported to the primary provider.

Pharmacologic Therapy

Several types of medications are routinely prescribed for patients with HF. The cornerstone of therapy for patients with HFrEF (systolic HF), which is the most common type of HF, includes a diuretic, an angiotensin system blocker, and a beta-blocker (Table 25-3). Many of these medications, particularly angiotensin system blockers and beta-blockers, improve symptoms and extend survival. Others, such as diuretics, improve symptoms but may not affect survival

TABLE 25-3 Select Medications Used to Treat Heart Failure

Medication	Therapeutic Effects	Key Nursing Considerations
Diuretics		
Loop diuretics: furosemide	↓ Fluid volume overload ↓ Signs and symptoms of HF	Observe for electrolyte abnormalities, renal dysfunction, diuretic resistance, and ↓ BP. Carefully monitor I&O and daily weight (see Chart 25-2).
Thiazide diuretics: metolazone hydrochlorothiazide		
Aldosterone antagonists: spironolactone	Improves HF symptoms in advanced HF	Observe for ↑ serum K^+, ↓ serum Na^+.
Angiotensin System Blockers		
ACE Inhibitors: lisinopril enalapril	↓ BP and ↓ afterload Relieves signs and symptoms of HF Prevents progression of HF	Observe for symptomatic ↓ BP, ↑ serum K^+, cough, and worsening renal function.
ARBs: valsartan losartan	↓ BP and ↓ afterload Relieves signs and symptoms of HF Prevents progression of HF	Observe for symptomatic ↓ BP, ↑ serum K^+, and worsening renal function.
ARNI: sacubitril-valsartan	↓ BP and ↓ afterload ↓ Fluid volume overload ↓ Signs and symptoms of HF Prevents progression of HF	Observe for symptomatic ↓ BP, ↑ serum K^+, cough, dizziness, and renal failure.
Beta-Adrenergic–Blocking Agents (Beta-Blockers) carvedilol bisoprolol metoprolol	Dilates blood vessels and ↓ afterload ↓ Signs and symptoms of HF Improves exercise capacity	Observe for ↓ heart rate, symptomatic ↓ BP, dizziness, and fatigue.
Ivabradine	Decreases rate of conduction through the SA node	Observe for ↓ heart rate, symptomatic ↓ BP, dizziness, and fatigue.
Hydralazine-isosorbide dinitrate	Dilates blood vessels ↓ BP and ↓ afterload	Observe for symptomatic ↓ BP.
Digitalis digoxin	Improves cardiac contractility ↓ Signs and symptoms of HF	Observe for ↓ heart rate and digitalis toxicity.

ACE, angiotensin-converting enzyme; ARB, angiotensin receptor blocker; ARNI, angiotensin receptor-neprilysin inhibitor; BP, blood pressure; ↓, decreases; HF, heart failure; ↑, increases; I&O, input and output; K^+, potassium; Na^+, sodium; SA, sinoatrial.
Adapted from Burchum, J. R., & Rosenthal, L. D. (2019). *Lehne's pharmacology for nursing care* (9th ed.). St. Louis, MO: Elsevier.

(Meyer, 2019b). The patient with HFpEF (diastolic HF) may be prescribed a diuretic, most commonly an aldosterone antagonist (see Table 25-3), and may also be prescribed an angiotensin system blocker and/or a beta-blocker and find symptomatic relief; however, these drugs are not necessarily associated with improved survival in those patients (Borlaug & Colucci, 2019). Target doses for these medications and alternative medications for treating heart failure are identified in the ACC/AHA guidelines. Nurses, primary providers, and pharmacists work collaboratively toward achieving effective dosing of these medications (Yancy et al., 2013; Yancy et al., 2016; Yancy et al., 2017).

Diuretics

Diuretics are prescribed to remove excess extracellular fluid by increasing diuresis in patients with signs and symptoms of fluid overload. ACC/AHA guidelines advocate using the smallest dose of diuretic necessary to control fluid volume (Yancy et al., 2013). The type and dose of diuretic prescribed depend on clinical signs and symptoms and renal function. Careful patient monitoring and dose adjustments are necessary to balance the effectiveness of these medications with the side effects (Chart 25-2). Loop, thiazide, and aldosterone-blocking diuretics may be prescribed; these medications differ in their site of action in the kidney and their effects on renal electrolyte excretion and reabsorption.

Loop diuretics, such as furosemide, inhibit sodium and chloride reabsorption mainly in the ascending loop of Henle. Patients with HF and with severe volume overload are generally treated with a loop diuretic first (Burchum & Rosenthal, 2019). *Thiazide diuretics*, such as metolazone, inhibit sodium and chloride reabsorption in the early distal tubules. Both of these classes of diuretics increase potassium excretion; therefore, patients treated with these medications must have their serum potassium levels closely monitored. Diuretics can also lead to orthostatic hypotension and kidney injury. Both a loop and a thiazide diuretic may be used in patients with severe HF who are unresponsive to a single diuretic. The need for diuretics can be decreased if the patient avoids excessive fluid intake (e.g., more than 2000 mL/day) and adheres to a low sodium diet (e.g., no more than 2 g/day).

Aldosterone antagonists, such as spironolactone, are potassium-sparing diuretics that block the effects of aldosterone in the distal tubule and collecting duct (Yancy et al., 2016). As noted previously, they are frequently prescribed for patients with HFpEF. Serum creatinine and potassium levels are monitored frequently (e.g., within the first week and then

Chart 25-2 PHARMACOLOGY
Administering and Monitoring Diuretic Therapy

When nursing care involves diuretic therapy for conditions such as heart failure, the nurse needs to administer the medication and monitor the patient's response carefully, as follows:

- Prior to administration of the diuretic, check laboratory results for electrolyte depletion, especially potassium, sodium, and magnesium.
- Prior to administration of the diuretic, check for signs and symptoms of volume depletion, such as orthostatic hypotension, lightheadedness, and dizziness.
- Administer the diuretic at a time conducive to the patient's lifestyle—for example, early in the day to avoid nocturia.
- Monitor urine output during the hours after administration, and analyze intake, output, and daily weights to assess response.
- Monitor blood pressure for orthostatic changes.
- Continue to monitor serum electrolytes for depletion. Replace potassium with increased oral intake of food rich in potassium or potassium supplements. Replace magnesium as needed.
- Monitor for hyperkalemia in patients receiving potassium-sparing diuretics.
- Continue to assess for signs of volume depletion.
- Monitor creatinine for increased levels indicative of diuretic-induced renal dysfunction.
- Monitor for elevated uric acid level and signs and symptoms of gout.
- Assess lungs sounds and edema to evaluate response to therapy.
- Monitor for adverse reactions such as arrhythmias.
- Assist patients to manage urinary frequency and urgency associated with diuretic therapy.

Adapted from Burchum, J. R., & Rosenthal, L. D. (2019). *Lehne's pharmacology for nursing care* (10th ed.). St. Louis, MO: Elsevier.

every 4 weeks) when spironolactone is first given. These drugs are not prescribed for patients with an elevated serum creatinine.

Loop diuretics are administered IV for exacerbations of HF when rapid diuresis is necessary, as when pulmonary edema is present (see later discussion). Diuretics improve the patient's symptoms, provided that renal function is adequate. As HF progresses, cardiorenal syndrome may develop or worsen. Cardiorenal syndrome is a type of prerenal acute kidney injury characterized by a disruption in adequate blood flow to the kidneys. Patients with this syndrome are resistant to diuretics and may require other interventions to deal with congestive signs and symptoms.

Angiotensin System Blockers

Angiotensin system blockers include classes of medications such as the ACE inhibitors, angiotensin receptor blockers (ARBs), and angiotensin receptor-neprilysin inhibitors (ARNIs).

Angiotensin-Converting Enzyme Inhibitors

ACE inhibitors, such as lisinopril, have been found to relieve clinical manifestations of HF and significantly decrease mortality and morbidity in patients with HFrEF. Specifically, they slow the progression of HF, improve exercise tolerance, and decrease the number of hospitalizations in patients with HFrEF (Yancy et al., 2013; Yancy et al., 2017). ACE inhibitors are also appropriate for hypertension management in patients with HFpEF (Yancy et al., 2017). Available as oral and IV medications, ACE inhibitors promote vasodilation and diuresis, ultimately decreasing both afterload and preload. Vasodilation reduces resistance to left ventricular ejection of blood, diminishing the heart's workload and improving ventricular emptying. ACE inhibitors decrease the secretion of aldosterone, a hormone that causes the kidneys to retain sodium and water. ACE inhibitors also promote renal excretion of sodium and fluid (while retaining potassium), thereby reducing left ventricular filling pressure and decreasing pulmonary congestion. These agents are also recommended for prevention of HF in patients at risk due to vascular disease and diabetes (Yancy et al., 2013; Yancy et al., 2017).

Patients receiving ACE inhibitors are monitored for hypotension, hyperkalemia (increased potassium in the blood), and alterations in renal function, especially if they are also receiving diuretics. Because ACE inhibitors cause the kidneys to retain potassium, the patient who is also receiving a loop diuretic or a thiazide diuretic may not need to take oral potassium supplements. However, the patient receiving a potassium-sparing diuretic, such as an aldosterone antagonist, which does not cause potassium loss with diuresis, must be carefully monitored for hyperkalemia. ACE inhibitors may be discontinued if the potassium level remains greater than 5.5 mEq/L or if the serum creatinine rises.

An adverse effect of ACE inhibitors includes a dry, persistent cough that may not respond to cough suppressants due to the inhibition of the enzyme kininase, which inactivates bradykinin. The nurse should carefully assess any cough in a patient taking an ACE inhibitor, as this symptom can also indicate a worsening of ventricular function and failure. In less than 1% of patients, ACE inhibitors may cause an allergic reaction accompanied by angioedema. This reaction tends to occur more frequently in African Americans and women (Yancy et al., 2016; Yancy et al., 2017). If angioedema affects the oropharyngeal area and impairs breathing, the ACE inhibitor must be stopped immediately and appropriate emergency care must be provided.

If the patient cannot continue taking an ACE inhibitor because of development of cough, an elevated creatinine level, or hyperkalemia, an ARB, an ARNI, or a combination of hydralazine and isosorbide dinitrate is prescribed (see Table 25-3).

Angiotensin Receptor Blockers

Whereas ACE inhibitors block the conversion of angiotensin I to angiotensin II, ARBs, such as valsartan, block the vasoconstricting effects of angiotensin II at the angiotensin II receptors. ARBs are commonly prescribed as an alternative to ACE inhibitors, as they are associated with reduced morbidity and mortality in patients with HFrEF and can provide symptomatic relief in patients with HFpEF who are intolerant of ACE inhibitors (Yancy et al., 2013; Yancy et al., 2017). ARBs do not inhibit kininase; therefore, ARBs are not associated with the bothersome cough that occurs with some patients prescribed an ACE inhibitor.

Angiotensin Receptor-Neprilysin Inhibitors

An ARNI combines an ARB with a neprilysin inhibitor. Neprilysin is an enzyme that breaks down natriuretic peptides. Participants with HFrEF enrolled in clinical trials who were prescribed an ARNI demonstrated a significant reduction in cardiovascular death or hospitalization as compared with participants prescribed an ACE inhibitor (Meyer, 2019b). Based on these findings, updated ACC/AHA guidelines advocate prescribing an ARNI as first-line angiotensin system blocker therapy for most patients with symptomatic HFrEF. However, an ARNI is reportedly a costlier option than most ACE inhibitors and ARBs, which may preclude its practical use. For patients unable to take an ARNI, an ACE inhibitor or ARB is a good alternative. An ARNI should not be administered concurrently or within 36 hours of an ACE inhibitor as concomitant dosing with both agents is associated with angioedema (Yancy et al., 2016; Yancy et al., 2017). Adverse effects associated with use of an ARNI are similar to those associated with ACE inhibitor or ARB use; therefore, the nurse should assess for hypotension, renal insufficiency, and angioedema in patients taking an ARNI (Yancy et al., 2016; Yancy et al., 2017). The first U.S. Food and Drug Administration (FDA) approved ARNI for use in patients with HF is sacubitril-valsartan.

Beta-Blockers

Beta-blockers block the adverse effects of the sympathetic nervous system. They relax blood vessels, lower blood pressure, decrease afterload, and decrease cardiac workload. Beta-blockers, such as carvedilol, have been found to improve functional status and reduce mortality and morbidity in patients with HF (Burchum & Rosenthal, 2019). In addition, beta-blockers have been recommended for patients with asymptomatic HFrEF to prevent progression and the onset of symptoms of HF, even if patients do not have a history of MI. The therapeutic effects of these drugs may not be seen for several weeks or even months (Yancy et al., 2013, Yancy et al., 2017).

Beta-blockers can produce a number of side effects, including dizziness, hypotension, bradycardia, fatigue, and depression. Side effects are most common in the initial few weeks of treatment. Because of the potential for side effects, beta-blockers are started at a low dose. The dose is titrated up slowly (every few weeks), with close monitoring after each dosage increase. Nurses educate patients about potential symptoms during the early phase of treatment and stress that adjustment to the drug may take several weeks. Nurses must also provide support to patients going through this symptom-provoking phase of treatment. Because beta-blockade can cause bronchiole constriction, these drugs are used with caution in patients with a history of bronchospastic diseases such as asthma.

Ivabradine

Ivabradine is a new agent that is a hyperpolarization-activated cyclic nucleotide channel blocker. It is a medication with unique electrophysiologic effects, characterized by its negative chronotropic effect on the sinoatrial node, thereby decreasing the heart rate without targeting the neurohormonal system. It is indicated as an adjunct agent to beta-blockers in patients with symptomatic HFrEF and with high resting heart rates of at least 70 bpm (Koruth, Lala, Pinney, et al., 2017). It may also be beneficial for patients with HFrEF who cannot tolerate beta-blockers (Yancy et al., 2017). Adverse effects of ivabradine include bradycardia resulting in dizziness and fatigue; it is also associated with an increased risk of atrial fibrillation (Koruth et al., 2017).

Hydralazine and Isosorbide Dinitrate

A combination of hydralazine and isosorbide dinitrate may be an alternative medication for patients who cannot take any of the three angiotensin system blockers (i.e., ACE inhibitor, ARB, and ARNI), so long as the patient's systolic BP is at least 90 mm Hg. Nitrates (e.g., isosorbide dinitrate) cause venous dilation, which reduces the amount of blood return to the heart and lowers preload. Hydralazine lowers systemic vascular resistance and left ventricular afterload. Hydralazine-isosorbide dinitrate is associated with decreased hospitalizations and improved survival in patients with HFrEF; however, these improvements are not as robust as those associated with angiotensin system blockers (Meyer, 2019b; Yancy et al., 2017). Adverse effects may include hypotension, and rarely, a lupus-type reaction (Meyer, 2019b).

Digitalis

For many years, digitalis (i.e., digoxin) was considered an essential agent for the treatment of HF. With the introduction of newer medications, it is not prescribed as often. Digoxin increases the force of myocardial contraction and slows conduction through the atrioventricular node. It improves contractility, increasing left ventricular output. Although the use of digoxin does not result in decreased mortality rates among patients with HFrEF, it can be effective in decreasing the symptoms of HF and may help prevent hospitalization (Yancy et al., 2013). Patients with renal dysfunction and older patients should receive smaller doses of digoxin, as it is excreted through the kidneys.

A key concern associated with digoxin therapy is digitalis toxicity. Clinical manifestations of toxicity include anorexia, nausea, visual disturbances, confusion, and bradycardia. The serum potassium level is monitored because the effect of digoxin is enhanced in the presence of hypokalemia and digoxin toxicity may occur. A serum digoxin level is obtained if the patient's renal function changes or there are symptoms of toxicity.

Intravenous Infusions

IV inotropes (e.g., dopamine, dobutamine, milrinone) increase the force of myocardial contraction; as such, they may be indicated for hospitalized patients with pulmonary edema (i.e., acute decompensated HF). These agents are used for patients who do not respond to routine pharmacologic therapy and are reserved for patients with severe ventricular dysfunction, low blood pressure, or impaired perfusion and evidence of significantly depressed CO, with or without congestion. They are used with caution, as some studies have associated their use with increased mortality (Malotte, Saguros, & Groninger, 2018; Yancy et al., 2013). Patients usually require admission to the intensive care unit (ICU) and may

also have hemodynamic monitoring with a pulmonary artery catheter or alternative technology (see Chapter 21). Hemodynamic data are used to assess cardiac function and volume status and to guide therapy with inotropes, vasodilators, and diuretics (Urden, Stacy, & Lough, 2018). Patients with end-stage HF who cannot be weaned from IV inotropes may be candidates for continuous therapy at home (Malotte et al., 2018).

Dopamine

Dopamine is a vasopressor given to increase BP and myocardial contractility. Given at low doses, a dopamine infusion may be helpful as an adjunct therapy along with loop diuretics in improving diuresis, preserving renal function, and improving renal blood flow (Yancy et al., 2013).

Dobutamine

Dobutamine is given to patients with significant left ventricular dysfunction and hypoperfusion. A catecholamine, dobutamine stimulates the beta-1 adrenergic receptors. Its major action is to increase cardiac contractility and renal perfusion to enhance urine output. However, it also increases the heart rate and can precipitate ectopic beats and tachyarrhythmias (Burchum & Rosenthal, 2019).

Milrinone

Milrinone is a phosphodiesterase inhibitor that leads to an increase in intracellular calcium within myocardial cells, increasing their contractility (Ayres & Maani, 2019). This agent also promotes vasodilation, resulting in decreased preload and afterload and reduced cardiac workload. Milrinone is administered IV to patients with severe HF, including patients who are waiting for heart transplantation (see Chapter 24). Because the drug causes vasodilation, the patient's blood pressure is monitored prior to administration; if the patient is hypovolemic, the blood pressure could drop quickly. The major side effects are hypotension and increased ventricular arrhythmias. Blood pressure and ECG are monitored closely during and following infusions of milrinone.

Vasodilators

Intravenous vasodilators such as IV nitroglycerin, nitroprusside, or nesiritide may enhance symptom relief for acutely decompensated HF (Yancy et al., 2013). Their use is contraindicated in patients who are hypotensive. Blood pressure is continually assessed in patients receiving IV vasodilator infusions.

Adjunct Medications for Heart Failure

The importance of ensuring that patients with hypertension take prescribed antihypertensive agents as prescribed is of paramount importance (see Chapter 27 for further discussion of antihypertensive medications). Target blood pressures should be less than 130/80 mm Hg. Maintaining BPs at these levels is associated with reduced likelihood of morbid progression to symptomatic HF in patients who are asymptomatic. It is also associated with improved morbidity in patients who are symptomatic with both HFrEF and HFpEF (Yancy et al., 2017).

Anemia is independently associated with HF disease severity, and iron deficiency appears to be uniquely associated with reduced exercise capacity. IV iron repletion in patients with HF may improve functional capacity and quality of life; however, there is mixed evidence to support the use of oral iron supplementation. Erythropoietin-stimulating agents, such as darbepoetin alfa, are not recommended in patients with both HF and anemia as a risk of thromboembolic events associated with their use has been observed during clinical trials (Yancy et al., 2017).

Anticoagulants may be prescribed, especially if the patient has a history of atrial fibrillation or a thromboembolic event. Antiarrhythmic drugs such as amiodarone may be prescribed for patients with arrhythmias, along with an evaluation for device therapy with an implantable cardioverter defibrillator (ICD) (see Chapter 22). Medications to manage hyperlipidemia (e.g., statins) are also routinely prescribed, in tandem with guidance on nutritional therapy (see following section). It is recommended that patients with HF avoid nonsteroidal anti-inflammatory drugs (NSAIDs) such as ibuprofen because the risk of decreased renal perfusion is higher, especially in older adults (Schwartz, Schmader, Hanlon, et al., 2018).

Adjunct Therapies for Heart Failure

Additional therapies that may be indicated in the treatment of patients with HF include nutritional therapy, supplemental oxygen, management of sleep disorders, and procedural or surgical interventions.

Nutritional Therapy

Following a low sodium (no more than 2 g/day) diet and avoiding excessive fluid intake are usually recommended, although studies differ regarding the effectiveness of sodium restriction (Yancy et al., 2013). Decreasing dietary sodium reduces fluid retention and the symptoms of peripheral and pulmonary congestion. The purpose of sodium restriction is to decrease the amount of circulating blood volume, which decreases myocardial work. A balance should be achieved between the patient's ability to adhere to the diet and the recommended guidelines.

Nutritional supplements, such as vitamins and antioxidants, are not recommended for patients with HF as no benefits are associated with their use. Omega-3 polyunsaturated fatty acid (PUFA) supplementation is associated with decreased fatal cardiovascular events and is recommended for patients with either HFrEF or HFpEF, unless contraindicated (Yancy et al., 2013).

Any change in eating patterns should consider good nutrition as well as the patient's likes, dislikes, and cultural food patterns. Patient adherence is important because dietary indiscretions may result in exacerbations of HF symptoms. However, behavioral changes in eating patterns are difficult for many patients to achieve.

Supplemental Oxygen

Oxygen therapy may become necessary as HF progresses based on the degree of pulmonary congestion and resulting hypoxia. Some patients require supplemental oxygen only during periods of activity (see Chapter 20 for further discussion of oxygen delivery systems).

Management of Sleep Disorders

Sleep disorders, including sleep apnea, are common in patients with HF. It is estimated that 61% of patients with HF have either central or obstructive sleep apnea (OSA). A formal sleep study should be performed. Continuous positive airway pressure (CPAP) might be recommended if results from the sleep study suggest OSA (see Chapter 18). CPAP has been shown to improve sleep quality, reduce apneic episodes and excessive daytime sleepiness, and improve nocturnal oxygenation in patients with OSA and HF (Yancy et al., 2017).

Procedural and Surgical Interventions

A number of procedures and surgical approaches may benefit patients with HF. If the patient has underlying CAD, coronary artery revascularization with PCI or coronary artery bypass surgery (see Chapter 23) may be considered. Ventricular function may improve in some patients when coronary flow is increased.

Patients with HF are at high risk for arrhythmias, and sudden cardiac death is common among patients with advanced HF. In patients with severe left ventricular dysfunction and the possibility of life-threatening arrhythmias, placement of an ICD can prevent sudden cardiac death and extend survival (see Chapter 22). Candidates for an ICD include those with an EF less than 35%, including those with and without a history of ventricular arrhythmias (Yancy et al., 2013).

Patients with HF who do not improve with standard therapy may benefit from **cardiac resynchronization therapy (CRT)**. CRT involves the use of a biventricular pacemaker to treat electrical conduction defects and to synchronize ventricular contractions. A prolonged QRS duration on ECG indicates left bundle branch block, which is a type of delayed conduction that is frequently seen in patients with HF. This problem results in asynchronous conduction and contraction of the right and left ventricles, which can further decrease EF (Yancy et al., 2013). The use of a pacing device with leads placed in the right atrium, right ventricle, and left ventricular cardiac vein can synchronize the contractions of the right and left ventricles (Fig. 25-3). This intervention improves CO, optimizes myocardial energy consumption, reduces mitral regurgitation, and slows the ventricular remodeling process. For patients with a CRT, improvement of left ventricular EF is associated with reduced rates of ventricular arrhythmias. There are combination devices available for patients who require CRT and an ICD (Gulati & Udelson, 2018). See Chapter 22 for further discussion of care of patients with pacemakers, CRT, and ICDs.

Ultrafiltration is an alternative intervention for patients with severe fluid overload. It is reserved for patients with advanced HF who are resistant to diuretic therapy (Yancy et al., 2013). A dual-lumen central IV catheter is placed, and the patient's blood is circulated through a small bedside filtration machine. Liters of excess fluid and plasma are removed slowly from the patient's intravascular circulating volume over a number of hours. The patient's output of filtration fluid, blood pressure, and hemoglobin (analyzed for hemoconcentration) are monitored as indicators of volume status.

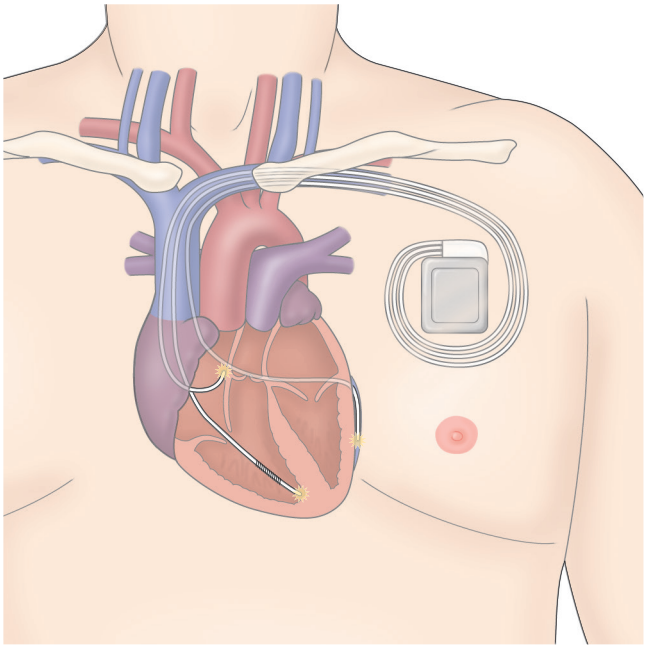

Figure 25-3 • Cardiac resynchronization therapy. To pace both ventricles, pacemaker leads are placed in the right atrium and right ventricle; a third lead is threaded through the coronary sinus into a lateral vein on the wall of the left ventricle.

Research on ultrafiltration is ongoing, and targets comparisons of its efficacy to diuretics and the optimal fluid removal target (Costanzo, 2019).

For some patients with end-stage HF, cardiac transplantation is one of the few options for long-term survival. Patients with ACC/AHA stage D HF who may be eligible are referred for consideration of transplantation. Some of these patients require mechanical circulatory assistance with an implanted ventricular assist device as a bridge therapy to cardiac transplantation. A left ventricular assist device may also be implanted as *destination therapy* (permanent therapy) for select patients (Yancy et al., 2013).

Gerontologic Considerations

Several normal age-related changes increase the frequency of HF: increased systolic blood pressure, increased ventricular wall thickness, and increased myocardial fibrosis. There are a number of reasons that older adults may need to be hospitalized with HF (Albert, Barnason, Deswal, et al., 2015). Older adults may not always detect or accurately interpret common symptoms of HF such as shortness of breath, or they may have atypical symptoms such as weakness and somnolence. Decreased renal function can make the older patient resistant to diuretics and more sensitive to changes in volume. The administration of diuretics to older men requires nursing surveillance for bladder distention caused by urethral obstruction from an enlarged prostate gland. The bladder may be assessed with an ultrasound scanner or the suprapubic area palpated for an oval mass and percussed for dullness, indicative of bladder fullness. Urinary frequency and urgency may be particularly stressful to older patients, as many have arthritis and limited mobility.

NURSING PROCESS

The Patient with Heart Failure

Despite advances in treatment of HF, morbidity and mortality remain high. Nurses have a major impact on outcomes for patients with HF, especially in the areas of patient education and monitoring.

Assessment

Nursing assessment for the patient with HF focuses on observing for effectiveness of therapy and for the patient's ability to understand and implement self-care management strategies. Signs and symptoms of worsening HF are analyzed and reported to the patient's provider so that therapy can be adjusted. The nurse also explores the patient's emotional response to the diagnosis of HF, because it is a chronic and often progressive condition that is commonly associated with depression and other psychosocial issues (Jiang, Shorey, Seah, et al., 2018).

Health History

The health history focuses on the signs and symptoms of HF, such as dyspnea, fatigue, and edema. Sleep disturbances, particularly sleep suddenly interrupted by shortness of breath, may be reported. Patients are asked about the number of pillows needed for sleep, edema, abdominal symptoms, altered mental status, activities of daily living, and the activities that cause fatigue. Nurses need to be aware of the variety of clinical manifestations that may indicate worsening HF and assess the patient accordingly. While obtaining the patient's history, the nurse assesses the patient's understanding of HF, self-care management strategies, and the patient's ability and willingness to adhere to those strategies.

Physical Examination

The patient is observed for restlessness and anxiety that might suggest hypoxia from pulmonary congestion. The patient's level of consciousness is also evaluated for any changes, as low CO can decrease the flow of oxygen to the brain.

The rate and depth of respirations are assessed along with the effort required for breathing. The lungs are auscultated to detect crackles and wheezes (Meyer, 2019a). Crackles are produced by the sudden opening of edematous narrowed airways and alveoli. They may be heard at the end of inspiration and are not cleared with coughing. Wheezing may also be heard in some patients who have bronchospasm along with pulmonary congestion.

The blood pressure is carefully evaluated, because patients with HF may present with hypotension or hypertension. Patients may be assessed for orthostatic hypotension, especially if they report lightheadedness, dizziness, or syncope. The heart is auscultated for an S_3 heart sound, which is an early sign that increased blood volume fills the ventricle with each beat. Heart rate and rhythm are also documented, and patients are often placed on continuous ECG monitoring in the hospital setting. When the heart rate is rapid or very slow, the CO decreases and potentially worsens the HF. JVD is assessed with the patient sitting at a 45-degree angle; distention greater than 4 cm above the sternal angle is considered abnormal and indicative of right ventricular failure (Bickley, 2017). This is an estimate, not a precise measurement, of high central venous pressure.

The nurse assesses peripheral pulses and rates their volume on a scale from 0 (not palpable) to 3+ (bounding). The skin is also assessed for color and temperature. With significant decreases in SV, there is a decrease in perfusion to the periphery, decreasing the volume of pulses and causing the skin to feel cool and appear pale or cyanotic. The feet and lower legs are examined for edema; if the patient is supine in bed, the sacrum and back are also assessed for edema. The upper extremities may also become edematous in some patients. Edema is typically rated on a scale from 0 (no edema) to 4+ (severe pitting edema).

The abdomen is examined for tenderness and hepatomegaly. The presence of firmness, distention, and possible ascites is noted. The liver may be assessed for hepatojugular reflux. The patient is asked to breathe normally while manual pressure is applied over the right upper quadrant of the abdomen for 30–60 s. If neck vein distention increases more than 1 cm, the finding is positive for increased venous pressure.

If the patient is hospitalized, the nurse measures urinary output and evaluates it in terms of diuretic use. Intake and output records are rigorously maintained and analyzed. It is important to track whether the patient has excreted excessive volume (i.e., negative fluid balance is generally the goal). The intake and output is then compared with changes in weight. Although diuresis is expected, the patient with HF must also be monitored for **oliguria** (diminished urine output, less than 0.5 mL/kg/h for at least 6 h or <400 mL/24 h) or **anuria** (urine output of less than 50 mL/24 h) because of the risk of renal dysfunction.

The patient is weighed daily in the hospital or at home, at the same time of day, with the same type of clothing, and on the same scale. If there is a significant change in weight (i.e., 2–3-lb increase in a day or 5-lb increase in a wk), the primary provider is notified and medications are adjusted (e.g., the diuretic dose is increased).

Diagnosis

Nursing Diagnoses

Based on the assessment data, major nursing diagnoses may include the following:

- Activity intolerance associated with decreased CO
- Hypervolaemia associated with the HF syndrome
- Anxiety associated with clinical manifestations of HF
- Powerlessness associated with chronic illness and hospitalizations
- Impaired family ability to manage regime

Collaborative Problems/Potential Complications

Potential complications may include the following:

- Pulmonary edema
- Hypotension, poor perfusion, and cardiogenic shock (see Chapter 11)
- Arrhythmias (see Chapter 22)
- Thromboembolism (see Chapter 26)
- Pericardial effusion (see later discussion in this chapter)

Planning and Goals

Major goals for the patient may include promoting activity and reducing fatigue, relieving fluid overload symptoms,

decreasing anxiety or increasing the patient's ability to manage anxiety, encouraging the patient to verbalize their ability to make decisions and influence outcomes, and educating the patient and family about health management.

Nursing Interventions

Nursing interventions revolve around promoting the patient's activity tolerance, managing the patient's fluid volume status, assisting the patient so that anxiety is relieved, helping to minimize any feelings of powerlessness that the patient might experience, and assisting the patient and family members to effectively manage the patient's health. In addition, nursing interventions must be attuned to prevent and manage acute complications that can be experienced by patients with HF.

Promoting Activity Tolerance

Reduced physical activity caused by HF symptoms leads to physical deconditioning that worsens the patient's symptoms and exercise tolerance. Prolonged inactivity, which may be self-imposed, should be avoided because of its deconditioning effects and risks, such as pressure injuries (especially in edematous patients) and venous thromboembolism. An acute illness that exacerbates HF symptoms or requires hospitalization may be an indication for temporary bed rest. Otherwise, some type of physical activity every day should be encouraged. A typical program for a patient with HF might include a daily walking regimen, with the duration increased over a 6-wk period. The primary provider, nurse, and patient collaborate to develop a schedule that promotes pacing and prioritization of activities. The schedule should alternate activities with periods of rest and avoid having two significant energy-consuming activities occur on the same day or in immediate succession. Before undertaking physical activity, the patient should be given guidelines similar to those noted in Chart 25-3. Because some patients may be severely debilitated, they may need to limit physical activities to only 3–5 min at a time, one to four times per day. The patient should increase the duration of the activity, then the frequency, before increasing the intensity of the activity (Piña, 2019).

Barriers to performing activities are identified, and methods of adjusting an activity are discussed. For example, vegetables can be chopped or peeled while sitting at the kitchen table rather than standing at the kitchen counter. Small, frequent meals decrease the amount of energy needed for digestion while providing adequate nutrition. The nurse helps the patient identify peak and low periods of energy, planning energy-consuming activities for peak periods. For example, the patient may prepare the meals for the entire day in the morning. Pacing and prioritizing activities help maintain the patient's energy to promote participation in regular physical activity.

The patient's response to activities needs to be monitored. If the patient is hospitalized, vital signs and oxygen saturation levels are monitored before, during, and immediately after an activity to identify whether they are within the desired range. Heart rate should return to baseline within 3 min following the activity. If the patient is at home, the degree of fatigue felt after the activity can be used to assess the response. If the patient tolerates the activity, short- and long-term goals can be developed to gradually increase the intensity, duration, and frequency of activity.

Adherence to exercise training is essential if the patient is to benefit from it, but it may be difficult for patients with other comorbid conditions (e.g., arthritis, anemia, cardiomyopathy, obesity, chronic kidney disease, chronic obstructive pulmonary disease) and those who have had HF for a longer time (Cattadori, Segurini, Picozzi, et al., 2018). Referral to a cardiac rehabilitation program may be indicated, especially for patients newly diagnosed with HF (Piña, 2019). A supervised program may also benefit those who need a structured environment, significant educational support, regular encouragement, and interpersonal contact.

Managing Fluid Volume

Patients with severe HF may receive IV diuretic therapy; however, patients with less severe symptoms are typically prescribed oral diuretics. Oral diuretics should be given early in the morning so that diuresis does not interfere with the patient's nighttime rest. Discussing the timing of medication administration is especially important for older patients who may have urinary urgency or incontinence. A single dose of a diuretic may cause the patient to excrete a large volume of fluid shortly after its administration.

The patient's fluid status is monitored closely by auscultating the lungs, monitoring daily body weight, and assisting the patient to adhere to a low sodium diet by reading food labels and avoiding high sodium foods such as canned, processed, and convenience foods (Chart 25-4). Weight gain in a patient with HF almost always reflects fluid retention. If the diet includes fluid restriction, the nurse can assist the patient to plan fluid intake throughout the day while respecting the patient's dietary preferences. If the patient is receiving IV fluids and medications, the amount of fluid needs to be monitored closely, and the primary provider or pharmacist can be consulted about the possibility of maximizing the amount of medication in the same volume of IV fluid (e.g., double concentrating to decrease the fluid volume given).

The patient is positioned or taught how to assume a position that facilitates breathing. The number of pillows may

Chart 25-3 HEALTH PROMOTION

An Exercise Program for Patients with Heart Failure

Before undertaking physical activity, the patient should be given the following guidelines:

- Talk with your primary provider for specific exercise program recommendations.
- Begin with low-impact activities such as walking.
- Start with warm-up activity followed by sessions that gradually build up to about 30 min.
- Follow your exercise period with cool-down activities.
- Avoid performing physical activities outside in extreme hot, cold, or humid weather.
- Wait 2 h after eating a meal before performing the physical activity.
- Ensure that you are able to talk during the physical activity; if you cannot do so, decrease the intensity of activity.
- Stop the activity if severe shortness of breath, pain, or dizziness develops.

Adapted from Piña, I. L. (2019). Cardiac rehabilitation in patients with heart failure. *UpToDate*. Retrieved on 9/11/2019 at: www.uptodate.com/contents/cardiac-rehabilitation-in-patients-with-heart-failure

Chart 25-4 HEALTH PROMOTION
Facts About Dietary Sodium

Although the major source of sodium in the average American diet is salt, many types of natural foods contain varying amounts of sodium. Even if no salt is added in cooking and if salty foods are avoided, the daily diet will still contain about 2000 mg of sodium. Fresh fruits and vegetables are low in sodium and should be encouraged.

Additives in Food

In general, food prepared at home is lower in sodium than restaurant or processed foods. Added food substances (additives), such as sodium alginate, which improves food texture, sodium benzoate, which acts as a preservative, and disodium phosphate, which improves cooking quality in certain foods, increase the sodium intake when included in the daily diet. Therefore, patients on low sodium diets should be advised to check labels carefully for words such as "salt" or "sodium," especially on canned foods. For example, without looking at the sodium content per serving found on the nutrition labels, when given a choice between a serving of potato chips and a cup of canned cream of mushroom soup, most would think that soup is lower in sodium. However, when the labels are examined, the lower sodium choice is found to be the chips. Although potato chips are *not* recommended in a low sodium diet, this example illustrates that it is important to read food labels to determine both sodium content and serving size.

Nonfood Sodium Sources

Sodium is contained in municipal water. Water softeners also increase the sodium content of drinking water. Patients on sodium-restricted diets should be cautioned against using nonprescription medications such as antacids, cough syrups, and laxatives. Salt substitutes may be allowed, but it is recognized that they are high in potassium. Over-the-counter medications should not be used without first consulting the patient's primary provider.

Promoting Dietary Adherence

If patients find food unpalatable because of the dietary sodium restrictions and/or the taste disturbances caused by the medications, they may refuse to eat or to follow the dietary regimen. For this reason, severe sodium restrictions should be avoided, and diuretic medication should be balanced with the patient's ability to restrict dietary sodium. A variety of flavorings, such as lemon juice, vinegar, and herbs, may be used to improve the taste of the food and facilitate acceptance of the diet. It is important to consider the patient's food preferences. Diet counseling and educational handouts can be geared toward a patient–family-centered approach and with cultural practices considered.

Adapted from American Heart Association (AHA). (2016). Shaking the salt habit. Retrieved on 10/24/2019 at: www.heart.org/HEARTORG/Conditions/HighBloodPressure/PreventionTreatmentofHighBloodPressure/Shaking-the-Salt-Habit_UCM_303241_Article.jsp#.Vzy9eNe3BK8

be increased, the head of the bed may be elevated, or the patient may sit in a recliner. In these positions, the venous return to the heart (preload) is reduced, pulmonary congestion is reduced, and pressure on the diaphragm is minimized. The lower arms can be supported with pillows to eliminate the fatigue caused by the pull of the patient's weight on the shoulder muscles. If the patient is experiencing acute decompensation, positioning them upright, preferably with the legs dangling over the side of the bed, has the immediate effect of decreasing venous return, decreasing right ventricular stroke volume, and decreasing lung congestion.

Because decreased circulation in edematous areas increases the risk of pressure injuries, the nurse assesses for skin breakdown and institutes preventive measures. Positioning to avoid pressure and frequent changes of position help prevent pressure injuries.

Controlling Anxiety

Patients with HF may exhibit signs and symptoms of anxiety. In addition to psychosocial sources of anxiety, the physiologic compensatory mechanisms include activation of neurohormones including catecholamines. Complex medical interventions, such as implantation of an ICD can provoke anxiety in patients and families. These sources of anxiety include living with the threat of shocks, role changes, and concerns about the patient's ability to carry out activities of daily living. The patient's anxiety may intensify at night and interfere with sleep. Emotional stress further stimulates the sympathetic nervous system, causing vasoconstriction, elevated arterial pressure, and increased heart rate. This sympathetic response increases cardiac workload.

When the patient exhibits anxiety, the nurse takes steps to promote physical comfort and provide psychological support. As mentioned previously, the patient may be more comfortable sitting in a recliner. Oxygen may be given during an acute event to diminish the work of breathing and increase the patient's comfort. In many cases, a family member's presence provides reassurance. Patients with HF rely on their families for many aspects of care; therefore, nurses should assess the needs of family caregivers and provide support to them (Hodson, Peacock, & Holtslander, 2019).

Along with reassurance, the nurse can begin educating the patient and family about techniques for controlling anxiety and avoiding anxiety-provoking situations. This includes how to identify factors that contribute to anxiety and how to use relaxation techniques to control anxious feelings. As the patient's anxiety decreases, cardiac function may improve and symptoms of HF may decrease.

Quality and Safety Nursing Alert

When patients with HF are delirious, confused, or anxious, restraints should be avoided. Restraints are likely to be resisted, and resistance inevitably increases the cardiac workload.

Minimizing Powerlessness

Patients with HF may feel overwhelmed with their diagnosis and treatment regimen, leading to feelings of powerlessness. Contributing factors may include lack of knowledge and lack of opportunity to make decisions, particularly if health care providers or family members do not encourage the patient to participate in the treatment decision-making process.

Nurses should help patients recognize their choices, and that they can positively influence the outcomes of their diagnosis and treatment. Taking time to listen actively to patients encourages them to express their concerns and ask questions. Other strategies include providing the patient with decision making opportunities, such as when activities are to occur,

or encouraging food and fluid choices consistent with the dietary restrictions. Encouragement is provided, progress is identified, and the patient is assisted to differentiate between factors that can and cannot be controlled.

In addition to feelings of powerlessness, patients with HF have a high incidence of depressive symptoms, which are associated with increased morbidity and mortality (Jiang et al., 2018). Because depressive symptoms are known to increase as the disease worsens, patients with HF need to be screened for depression so that it can be treated, hopefully maintaining the patient's functional status and quality of life.

Assisting Patients and Families to Effectively Manage Health

Therapeutic regimens for HF are complex and require the patient and family to make significant lifestyle changes. An inability or unwillingness to adhere to dietary and pharmacologic recommendations can lead to episodes of acute decompensated HF and hospitalization. Nonadherence with prescribed diet and fluid restrictions and medications cause many hospital readmissions. Nursing research findings suggest that for some patients with HF who are taking more than one medication daily, the decision to not take HF medications as prescribed may actually reflect their efforts to best manage their personal health, and, therefore, may be a self-care strategy (see the Nursing Research Profile in Chart 25-5) (Meraz, 2020).

Nurses have a key role in managing episodes of acute decompensated HF and in developing a comprehensive education and discharge plan to prevent hospital readmissions and increase the patient's quality of life. Because of the high cost of hospitalization for HF, the Centers for Medicare & Medicaid Services (CMS) initiated a program that reduces reimbursement to hospitals with a high 30-d readmission rate (U.S. Department of Health and Human Services [HHS], 2019). Research continues to identify the most effective interventions that may decrease these rates. A number of evidence-based components are known to increase the effectiveness of a discharge plan for patients with HF, including providing them with comprehensive, patient-centered instructions, scheduling follow-up visits with their primary providers within 7 d of discharge, and following up by telephone within 3 d of discharge (Yancy et al., 2013; Yancy et al., 2016; Yancy et al., 2017).

Monitoring and Managing Potential Complications

Because HF is a complex and progressive condition, patients are at risk for many complications, including acute decompensated HF and pulmonary edema; hypotension and cardiogenic shock (see Chapter 11); arrhythmias (see Chapter 22); thromboembolism formation (see Chapter 26); and pericardial effusion (see later discussion).

Pulmonary Edema. As described previously, pulmonary edema is associated with acute decompensated HF that can lead to acute respiratory failure and death. If it is recognized early, pulmonary edema may be alleviated by increasing dosages of diuretics and by implementing other interventions to decrease preload. For instance, placing the patient in an upright position with the feet and legs dependent

Chart 25-5 NURSING RESEARCH PROFILE

Medication Nonadherence or Self-Care?

Meraz, R. (2020). Medication nonadherence or self-care? Understanding the medication decision-making process and experiences of older adults with heart failure. *Journal of Cardiovascular Nursing, 35*(1), 26–34.

Purpose

It is estimated that over half of patients with heart failure do not take their medications as prescribed. The reasons why many patients with heart failure do not adhere to their prescribed medication regimen are elusive, particularly since nonadherence is associated with hospitalization and emergency department visits. Therefore, the purpose of this study was to discover why patients with heart failure might not take their heart failure medications as prescribed.

Design

This was a qualitative study that used narrative inquiry and storytelling to discover why community dwelling patients with heart failure might not adhere to their medication regimen. Eleven participants, all 65 y of age or older, volunteered to be interviewed. Each of these participants had to live independently in the community setting, had to take at least two medications daily to treat heart failure, and had to self-administer these medications in order to be eligible to participate in this study.

Findings

Results from participant interviews found that patients' nonadherence with the prescribed medication regimen was deliberate, and not because of forgetfulness. In all reported instances, it was not contingent upon financial constraints, either. Some participants stopped taking a medication while others adjusted the dosages. Participants' deliberate decisions to adjust their medication regimen tended to be made based on the belief that they knew their own bodies and needs best, and felt that they were best equipped to take care of their own needs. Others noted that at times it was too difficult to get in contact with their primary providers or nurses, and that their primary providers or nurses were too busy to discuss their medication regimen with them. Most noted that they researched online their medications' effects and felt competent to manage their medication dosage without necessarily consulting their providers. Paradoxically, participants did not view their decisions to self-adjust their prescribed medication regimens as consonant with nonadherence.

Nursing Implications

Patients with heart failure who are prescribed multiple medications to treat their heart failure may not view self-adjustment of their prescriptions as tantamount to nonadherence. It seems likely that these self-care/nonadherent practices place these patients at risk for hospitalization and morbid complications. Participants in this study noted that one key reason that they self-adjusted their medications was because their primary providers and nurses were "too busy" to talk to them about their medications. Nurses are in an ideal position to talk to patients with heart failure about their prescriptions, discover their concerns about their medications, help them find ways to problem-solve and manage side effects, and help them proactively engage in self-care so that they avoid hospitalization.

reduces left ventricular workload. The treatment regimen and the patient's understanding of and adherence to it are assessed. The long-range approach for preventing pulmonary edema must be directed at identifying and managing its precipitating factors.

Clinical management of a patient with acute pulmonary edema due to left ventricular failure is directed toward reducing volume overload, improving ventricular function, and increasing oxygenation. These goals are accomplished through a combination of oxygen and ventilatory support, IV medication, and nursing assessment and interventions.

The patient's airway and breathing are assessed to determine the severity of respiratory distress, along with vital signs. The patient is placed on pulse oximetry, a cardiac monitor, and IV access is confirmed or established for administration of medications. Laboratory tests are obtained, including arterial blood gases, electrolytes, BUN, and creatinine; other laboratory tests that may be indicated include a complete blood cell count (CBC), BNP, or a serum troponin-I. A chest x-ray or an ultrasound of the lungs may be obtained to confirm the extent of pulmonary edema (Meyer, 2019a).

Oxygen is given in concentrations adequate to relieve hypoxemia and dyspnea; a non-rebreathing mask may be used initially. If respiratory failure is severe or persists, noninvasive positive-pressure ventilation is the preferred mode of assisted ventilation (Colucci, 2019). For some patients, endotracheal (ET) intubation and mechanical ventilation are required. The ventilator can provide positive end-expiratory pressure (PEEP), which is effective in reducing venous return, decreasing fluid movement from the pulmonary capillaries to the alveoli, and improving oxygenation (see Chapter 19). Oxygenation is monitored by pulse oximetry and by measurement of arterial blood gases.

The patient who is experiencing pulmonary edema is likely going to be highly anxious, as are the patient's family members. As the ability to breathe decreases, the patient's fear and anxiety rise proportionately, making the condition more severe. Reassuring the patient and family and providing skillful anticipatory nursing care are integral parts of the therapy. Because the patient is in an unstable condition, the nurse must remain with the patient. The nurse gives the patient simple, concise information in a reassuring voice about what is being done to treat the condition and the expected results.

Vasodilators such as IV nitroglycerin or nitroprusside may enhance symptom relief in pulmonary edema, as previously described (Meyer, 2019a). Blood pressure is continually assessed in patients receiving IV vasodilator infusions.

Furosemide or another loop diuretic is given by IV push or as a continuous infusion to produce a rapid diuretic effect. The blood pressure is closely monitored as the urine output increases, because it is possible for the patient to become hypotensive as intravascular volume decreases. The patient receiving diuretic therapy may excrete a large volume of urine within minutes after a potent diuretic is given. A bedside commode may be used to decrease the energy required by the patient and to reduce the resultant increase in cardiac workload induced by getting on and off a bedpan. If necessary, in order to carefully monitor urine output, an indwelling urinary catheter may be inserted.

Once the patient is stable, they may transition to oral diuretics; intake and output, daily weights, serum electrolytes, and creatinine are carefully monitored.

Many potential problems associated with HF therapy relate to the use of diuretics. These problems require ongoing nursing assessment and collaborative intervention:

Excessive and repeated diuresis can lead to hypokalemia (i.e., potassium depletion). Signs include ventricular arrhythmias, hypotension, muscle weakness, and generalized weakness. In patients receiving digoxin, hypokalemia can lead to digitalis toxicity, which increases the likelihood of dangerous arrhythmias. Patients with HF may also develop low levels of magnesium, which can add to the risk of arrhythmias. Hyperkalemia may occur, especially with the use of ACE inhibitors, ARBs, or spironolactone. Hyperkalemia can also lead to profound bradycardia and other arrhythmias. Prolonged diuretic therapy may produce hyponatremia (deficiency of sodium in the blood), which can result in disorientation, weakness, muscle cramps, and anorexia. Volume depletion from excessive fluid loss may lead to dehydration and hypotension. ACE inhibitors and beta-blockers may contribute to the hypotension. Other problems associated with diuretics include increased serum creatinine (indicative of renal dysfunction) and hyperuricemia (excessive uric acid in the blood), which leads to gout.

Promoting Home, Community-Based, and Transitional Care

Facilitating an easy and smooth transition back into the community is of paramount importance for the patient living with HF. Community-based nursing interventions for patients with HF can improve health outcomes and health care value as evidenced by reduced hospital readmissions for up to 6 mo. Important nursing interventions that keep the patient with HF out of the hospital incorporate a multidisciplinary care planning approach (Jones, Bowles, Richard, et al., 2017).

Educating Patients About Self-Care. The nurse provides patient education and involves the patient and family in the therapeutic regimen to promote understanding and adherence to the plan. When the patient recognizes that the diagnosis of HF can be successfully managed with lifestyle changes and medications, recurrences of acute HF lessen, unnecessary hospitalizations decrease, and life expectancy increases. Nurses play a key role in educating patients and their families about medication management, a low sodium diet, moderate alcohol consumption, activity and exercise recommendations, smoking cessation, how to recognize the signs and symptoms of worsening HF, and when to contact the primary provider (Jones et al., 2017). Use of the teach-back technique to assess the patient's comprehension of the instructions can increase education effectiveness and prevent rehospitalization (Esquivel, White, Carroll, et al., 2018) (see Chapter 3 for further discussion of teach-back methods). In order for teach-back to be effective, the nurse must ensure adequate time is dedicated to ensuring that patient learning occurs (Esquivel et al., 2018). A basic home education plan for the patient with HF is presented in Chart 25-6. The patient should receive a written copy of the instructions.

The patient's readiness to learn and potential barriers to learning are assessed. Patients with HF may have temporary or ongoing cognitive impairment due to their illness or other factors, increasing the need to rely on an identified caretaker (Hodson et al., 2019). An effective treatment

Chart 25-6 HOME CARE CHECKLIST
The Patient with Heart Failure

At the completion of education, the patient and/or caregiver will be able to:

- Identify heart failure as a chronic disease that can be managed with medications and specific self-management behaviors.
- State the impact of heart failure on physiologic functioning, ADLs, IADLs, roles, relationships, and spirituality.
- State the name, dose, side effects, frequency, and schedule for all medications.
- Take or administer medications daily, exactly as prescribed.
- Monitor effects of medication such as changes in breathing and edema.
- Know signs and symptoms of orthostatic hypotension and how to prevent it.
- Weigh self daily at the same time, with same clothes.
- Restrict sodium intake to no more than 2 g/day:
  - Adapt diet by examining nutrition labels to check sodium content per serving.
  - Avoid canned or processed foods, eating fresh or frozen foods.
  - Consult the written diet plan and the list of permitted and restricted foods.
  - Avoid salt use.
  - Avoid excesses in eating and drinking.
- Participate in prescribed activity program:
  - Participate in a daily exercise program.
  - Increase walking and other activities gradually, provided they do not cause unusual fatigue or dyspnea.
  - Conserve energy by balancing activity with rest periods.
  - Avoid activity in extremes of heat and cold, which increase the work of the heart.
  - Recognize that air-conditioning may be essential in a hot, humid environment.
- Develop methods to manage and prevent stress:
  - Avoid tobacco.
  - Avoid alcohol.
  - Engage in social and diversional activities.
- Identify community resources for peer and caregiver/family support:
  - Identify sources of support (e.g., friends, relatives, faith community).
  - Identify the contact details for support services for patients and their caregivers/families.
- Report immediately to the primary provider or clinic any of the following:
  - Gain in weight of 2–3 lb (0.9–1.4 kg) in 1 d, or 5 lb (2.3 kg) in 1 wk
  - Unusual shortness of breath with activity or at rest
  - Increased swelling of ankles, feet, or abdomen
  - Persistent cough
  - Loss of appetite
  - Development of restless sleep; increase in number of pillows needed to sleep
  - Profound fatigue
- State how to reach primary provider with questions or complications:
  - State time and date of follow-up appointments and diagnostic tests.
- Identify the need for health promotion, disease prevention, and screening activities.

ADLs, activities of daily living; IADLs, instrumental activities of daily living.

plan incorporates both the patient's goals and those of the health care providers. The nurse must consider cultural factors and adapt the education plan accordingly. Patients and families need to understand that effective HF management is influenced by choices made about treatment options and their ability to follow the treatment plan. They also need to be informed that health care providers are available to assist them in reaching their health care goals.

Continuing and Transitional Care. Successful management of HF requires adherence to a complex medical regimen that includes multiple lifestyle changes for most patients. Assistance may be provided through a number of options that optimize evidence-based recommendations for effective management of HF. Depending on the patient's physical status and the availability of family assistance, a home care referral or another type of disease management program may be indicated for a patient who has been hospitalized. Transitional care programs (hospital to home) that include telephone contact along with home visits have been shown to decrease rehospitalizations and increase patient quality of life (Cyrille & Patel, 2017; Jones et al., 2017). Home visits by nurses who are specially trained in managing patients with HF provide assessment and management tailored to specific individualized patient needs. Older patients and those who have long-standing heart disease with compromised physical stamina often require assistance with the transition to home after hospitalization for an acute episode of HF. The home health nurse assesses the physical environment of the home and makes suggestions for adapting the home environment to meet the patient's activity limitations. If stairs are a concern, the patient can plan the day's activities so that stair-climbing is minimized; for some patients, a temporary bedroom may be set up on the main level of the home. The home health nurse works with the patient and family to maximize the benefits of these changes.

The home health nurse also reinforces and clarifies information about dietary changes and fluid restrictions, the need to monitor symptoms and daily body weight, and the importance of obtaining follow-up care with the primary provider's office or clinic. Assistance may be given in scheduling and keeping appointments as well. The patient is encouraged to gradually increase their self-care and responsibility for carrying out the therapeutic regimen.

Evidence-based HF guidelines also recommend patient referral to HF clinics, which provide intensive nursing management along with medical care in a collaborative model. Many of these clinics are managed by advanced practice nurses. Referral to an HF clinic gives the patient ready access to continuing education, professional nursing and medical staff, and timely adjustments to treatment regimens. HF clinics can also provide outpatient treatment (e.g., IV diuretics, laboratory monitoring) as an alternative to hospitalization. Because of the additional support and coordination of care, patients managed through HF clinics have fewer

exacerbations of HF, fewer hospitalizations, decreased costs of medical care, and increased quality of life (Yancy, 2013).

Other disease management programs are carried out through telehealth, using telephones or computers to maintain contact with patients and to obtain patient data. This enables nurses and others to assess and manage patients on a frequent basis, without requiring patients to make frequent visits to health care providers. A variety of techniques ranging from simple telephone monitoring to sophisticated computer and video connections that monitor symptoms, daily weight, vital signs, heart sounds, and breath sounds may be used. Patient data may also include hemodynamics and other parameters transmitted from implantable devices. Studies have shown that telehealth management can decrease costs and hospitalizations for acute exacerbations of HF (Koehler, Koehler, Deckwart, et al., 2018).

End-of-Life Considerations. Because HF is a chronic and often progressive condition, patients and families need to consider issues related to the end-of-life and when palliative or hospice care should be considered (Cross, Kamal, Taylor, et al., 2019). Although the prognosis in patients with HF may be uncertain, issues often arise sooner or later related to the patient's thoughts and possible concerns about the use of complex treatment options (e.g., implantation of an ICD or a ventricular assist device [VAD]). VADs are an option for some patients with HF who have failed medical therapy and who are not candidates for cardiac transplantation. Discussions concerning the use of technology, preferences for end-of-life care, and advance directives should take place while the patient is able to participate and express preferences. For example, with the expanded use of ICDs in the HF population, patients with ICDs, their families, and their primary providers should receive instructions for ICD inactivation at the end-of-life to prevent inappropriate discharges. See Chapter 13 for further discussion of end-of-life care.

Evaluation

Expected patient outcomes may include:

1. Demonstrates tolerance for desired activity
   a. Describes adaptive methods for usual activities
   b. Schedules activities to conserve energy and reduce fatigue and dyspnea
   c. Maintains heart rate, blood pressure, respiratory rate, and pulse oximetry within the targeted range
2. Maintains fluid balance
   a. Exhibits decreased peripheral edema
   b. Verbalizes understanding of fluid intake and diuretic use
3. Decreased anxiety
   a. Avoids situations that produce stress
   b. Sleeps comfortably at night
   c. Reports decreased stress and anxiety
   d. Denies symptoms of depression
4. Makes sound decisions regarding care and treatment
   a. Demonstrates ability to influence outcomes
5. Patients and family members adhere to healthy regimen
   a. Performs and records daily weights
   b. Limits dietary sodium intake to no more than 2 g/day
   c. Takes medications as prescribed
   d. Reports symptoms of worsening HF
   e. Makes and keeps appointments for follow-up care
6. Exhibits no evidence of acute decompensation and pulmonary edema
7. Denies dyspnea
8. No apparent delirium or acute anxiety
9. Maintains fluid balance as noted previously
10. No evidence of electrolyte disturbances from diuretic therapy

COMPLICATIONS FROM HEART DISEASE

Cardiogenic Shock

Cardiogenic shock occurs when decreased CO leads to inadequate tissue perfusion and initiation of the shock syndrome. Cardiogenic shock most commonly occurs following acute MI when a large area of myocardium becomes ischemic and hypokinetic. It also can occur as a result of end-stage HF, cardiac tamponade, pulmonary embolism (PE), cardiomyopathy, and arrhythmias. Cardiogenic shock is a life-threatening condition with a high mortality rate. (See Chapter 11 for detailed information about the pathophysiology and management of cardiogenic shock.)

Thromboembolism

Patients with cardiovascular disorders are at risk for the development of arterial thromboemboli and venous thromboemboli (VTE). Intracardiac thrombi can form in patients with atrial fibrillation because the atria do not contract forcefully, resulting in slow and turbulent flow, and increasing the likelihood of thrombus formation. Mural thrombi can also form on ventricular walls when contractility is poor. Intracardiac thrombi can break off and travel through the circulation to other structures, including the brain, where they cause a stroke. Clots within the cardiac chambers can be detected by an echocardiogram and treated with anticoagulant agents, such as heparin and warfarin (see Chapter 26 for further discussion of assessment and treatment of VTEs; Table 26-2 discusses specific anticoagulant medications).

Decreased mobility and other factors in patients with cardiac disease also can lead to clot formation in the deep veins of the legs. Although signs and symptoms of deep vein thrombosis (DVT) can vary, patients may report leg pain and swelling and the leg may appear erythematous and feel warm. These clots can break off and travel through the inferior vena cava and through the right side of the heart into the pulmonary artery, where they can cause a pulmonary embolus (PE) (see Chapter 26 for further discussion of assessment and treatment of PE).

Pericardial Effusion and Cardiac Tamponade

Pericardial effusion (accumulation of fluid in the pericardial sac) may accompany advanced HF, pericarditis, metastatic carcinoma, cardiac surgery, or trauma. Normally, the pericardial sac contains about 20 mL of fluid, which is needed to decrease friction for the beating heart. An increase in

pericardial fluid raises the pressure within the pericardial sac and compresses the heart. This has the following effects:

- Elevated pressure in all cardiac chambers
- Decreased venous return due to atrial compression
- Inability of the ventricles to distend and fill adequately

Pericardial fluid may build up slowly without causing noticeable symptoms until a large amount (1 to 2 L) accumulates (Hoit, 2019). However, a rapidly developing effusion (e.g., hemorrhage into the pericardial sac from chest trauma) can quickly stretch the pericardium to its maximum size and cause an acute problem. As pericardial fluid increases, pericardial pressure increases, reducing venous return to the heart and decreasing CO. This can result in cardiac tamponade, which causes low CO and obstructive shock.

Clinical Manifestations

The signs and symptoms of pericardial effusion can vary according to whether the problem develops quickly or slowly. In acute cardiac tamponade, the patient suddenly develops chest pain, tachypnea, and dyspnea. JVD results from poor right atrial filling and increased venous pressure. Hypotension occurs from low CO, and heart sounds are often muted. The subacute presentation of a pericardial effusion is less dramatic. The patient may report chest discomfort or a feeling of fullness. The feeling of pressure in the chest may result from stretching of the pericardial sac. These patients also develop dyspnea, JVD, and hypotension over time (Hoit, 2019). Patients with cardiac tamponade typically have tachycardia in response to low CO. In addition to hypotension, patients with cardiac tamponade may develop **pulsus paradoxus**, a systolic blood pressure that is markedly lower during inhalation. Also known as paradoxical pulse, this finding is characterized by an abnormal difference of at least 10 mm Hg in systolic pressure between the point that it is heard during exhalation and the point that it is heard during inhalation. This difference is caused by the variation in cardiac filling that occurs with changes in intrathoracic pressure during breathing. The cardinal signs of cardiac tamponade are illustrated in Figure 25-4.

Assessment and Diagnostic Findings

An echocardiogram is performed to confirm the diagnosis and quantify the amount of pericardial fluid. A chest x-ray may show an enlarged cardiac silhouette due to pericardial effusion. The ECG shows tachycardia and may also show low voltage (Hoit, 2019). See Chapter 22 for discussion of the significance of ECG abnormalities.

Medical Management

Acute management of cardiac tamponade may include a pericardiocentesis; whereas, recurrent effusions may be managed with a pericardiotomy.

Pericardiocentesis

If cardiac function becomes seriously impaired, **pericardiocentesis** (puncture of the pericardial sac to aspirate pericardial fluid) is performed. During this procedure, the patient is monitored by continuous ECG and frequent vital signs. Catheter pericardiocentesis is performed using echocardiography to guide placement of the drainage catheter (Hoit, 2019).

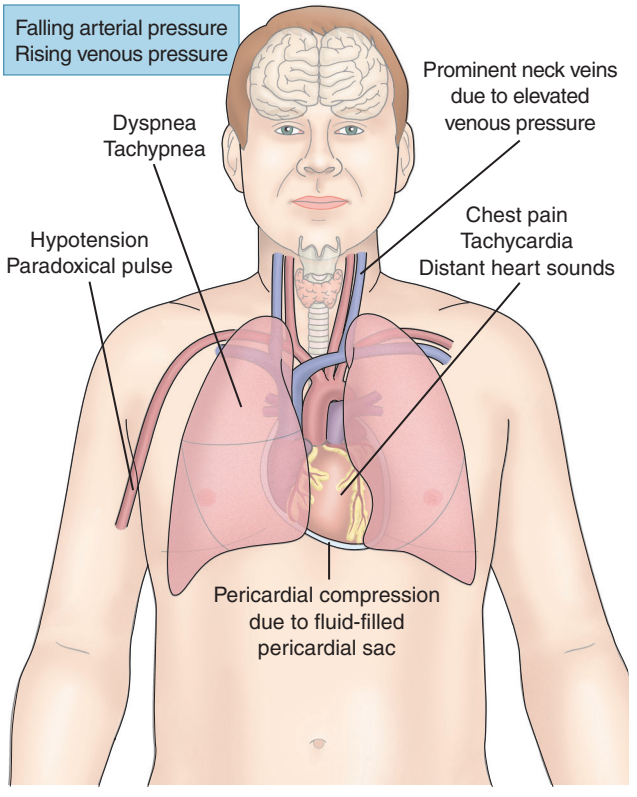

Figure 25-4 • Assessment findings in cardiac tamponade resulting from pericardial effusion include chest pain or fullness, dyspnea, tachypnea, jugular vein distention, hypotension, paradoxical pulse, tachycardia, and distant heart sounds.

A resulting decrease in central venous pressure and an associated increase in blood pressure after withdrawal of pericardial fluid indicate that the cardiac tamponade has been relieved. The patient almost always feels immediate relief. If there is a substantial amount of pericardial fluid aspirated, a small catheter may be left in place to drain recurrent accumulation of blood or fluid. Pericardial fluid is sent to the laboratory for examination for tumor cells, bacterial culture, chemical and serologic analysis, and differential blood cell count.

Complications of pericardiocentesis include coronary artery puncture, myocardial trauma, arrhythmias, pleural laceration, and gastric puncture. After pericardiocentesis, the patient's heart rhythm, blood pressure, venous pressure, and heart sounds are monitored frequently to detect possible recurrence of cardiac tamponade. A follow-up echocardiogram is also performed. If the effusion recurs, repeat aspiration is necessary. Cardiac tamponade may require treatment by open surgical drainage (pericardiotomy) (Hoit, 2019).

Pericardiotomy

Recurrent pericardial effusions, usually associated with neoplastic disease, may be treated by a **pericardiotomy** (pericardial window). Under general anesthesia, a portion of the pericardium is excised to permit the exudative pericardial fluid to drain into the lymphatic system. The nursing care following the procedure includes routine postsurgical care (see Chapter 16) in addition to observation for recurrent tamponade.

Cardiac Arrest

In cardiac arrest, the heart is unable to pump and circulate blood to the body's organs and tissues. It is often caused by an arrhythmia such as ventricular fibrillation, progressive bradycardia, or asystole (i.e., absence of cardiac electrical activity and heart muscle contraction). Cardiac arrest can also occur when electrical activity is present on the ECG but cardiac contractions are ineffective, a condition called **pulseless electrical activity (PEA)**. PEA may be caused by a variety of problems such as profound hypovolemia (e.g., hemorrhage). Diagnoses that are commonly associated with cardiac arrest include MI, massive pulmonary emboli, hyperkalemia, hypothermia, severe hypoxia, and medication overdose. Rapid identification of these problems and prompt intervention can restore circulation in some patients.

Clinical Manifestations

In cardiac arrest, consciousness, pulse, and blood pressure are lost immediately. Breathing usually ceases, but ineffective respiratory gasping may occur. The pupils of the eyes begin dilating in less than a minute, and seizures may occur. Pallor and cyanosis are seen in the skin and mucous membranes. The risk of organ damage, including irreversible brain damage, and of death increases with every minute that passes. A patient's age and overall health determine their vulnerability to irreversible damage. As soon as possible, the diagnosis of cardiac arrest must be made and action taken immediately to restore circulation.

Emergency Assessment and Management: Cardiopulmonary Resuscitation

Cardiopulmonary resuscitation (CPR) provides blood flow to vital organs until effective circulation can be reestablished. Following the recognition of unresponsiveness, a protocol for basic life support is initiated. The AHA Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care direct the current protocols for CPR, medical emergency teams, postcardiac arrest care, and acute respiratory compromise. The primary goal of resuscitation protocols is to save lives by preventing in-hospital cardiac arrest and optimizing outcomes (AHA, 2017).

The resuscitation process begins with the immediate assessment of the patient for breathing and consciousness, then a call for assistance, as CPR can be performed most effectively with the addition of more health care providers and equipment (e.g., defibrillator). The current resuscitation protocol recommends the following practices for CPR:

1. *Quick recognition of sudden cardiac arrest.* The patient is assessed for responsiveness and breathing.
2. *Activation of the Emergency Response System.* Within a medical facility, a call is made to alert the emergency response team. Outside of a medical facility, 911 is called to activate the Emergency Medical Service (EMS).
3. *Performance of high-quality CPR.* If there is no carotid pulse detected, chest compressions are initiated at a rate of 100 bpm.
4. *Rapid cardiac rhythm analysis and defibrillation* within 2 minutes for patients in ventricular fibrillation or pulseless ventricular tachycardia, followed by continuous chest compressions.

Rescue breathing is no longer recommended unless health care providers are present; if that is the case, it is then started after chest compressions. The airway is opened using a head-tilt/chin-lift maneuver, and any obvious material in the mouth or throat is removed. An oropharyngeal airway may be inserted if available to help maintain patency of the airway. Rescue ventilations are provided using a bag-valve mask or mouth-mask device. Oxygen is given at 100% during resuscitation to correct hypoxemia and improve tissue oxygenation.

Compressions are performed with the patient on a firm surface such as the floor or a cardiac board. The provider, facing the patient's side, places one hand in the center of the chest on the lower half of the sternum and positions the other hand on top of the first hand (Fig. 25-5). The chest is compressed 2 inches (approximately 5 cm) at a rate of 100 compressions/min. Complete recoil of the chest must be allowed between compressions to allow for cardiac filling. Interruptions in CPR to switch providers or check for a pulse are minimized (Panchal, Berg, Hirsch, et al., 2019). It is recommended providers switch every 2 minutes due to the exertion of delivering effective compressions.

Figure 25-5 • Chest compressions in cardiopulmonary resuscitation are performed by placing the heel of one hand in the center of the chest over the sternum and the other hand on top of the first hand. Elbows are kept straight and body weight is used to apply forceful compressions to the lower sternum. The patient should be on a hard surface such as a cardiac board. Reprinted with permission from Field, J. M., Kudenchuk, P. J., O'Connor, R. E., et al. (2009). *The textbook of emergency cardiovascular care and CPR*. Philadelphia, PA: Lippincott Williams & Wilkins.

Defibrillation

As soon as a monitor/defibrillator is available, monitor electrodes are applied to the patient's chest and the heart rhythm is analyzed. When an automated external defibrillator (AED) is used, the device is turned on, the pads are applied to the patient's chest, and the rhythm is analyzed by the defibrillator to determine whether a shock is indicated. When the ECG shows ventricular fibrillation or pulseless ventricular tachycardia, immediate defibrillation is the treatment of choice.

The AHA (2017) recommends the first defibrillation to occur within 2 minutes of the first documented, pulseless rhythm. Survival time decreases for every minute that defibrillation is delayed. Following defibrillation, high-quality chest compressions are resumed immediately. Survival after cardiac arrest has been improved by extensive education of health care providers and by the use of AEDs.

Advanced Cardiovascular Life Support

During a resuscitation, an advanced airway (e.g., endotracheal tube, tracheal tube) may be placed by a primary provider, nurse anesthetist, or respiratory therapist to ensure a patent airway and adequate ventilation. Following confirmation of the placement of airway (auscultation of breath sounds, observation of equal chest expansion, or a carbon dioxide detector), positive-pressure ventilation should be delivered without pausing chest compressions at a rate of one breath every 6 seconds, or 10 breaths/min (Kleinman, Goldberger, Rea, et al., 2017; Panchal et al., 2019).

Specific subsequent advanced support interventions depend on the assessment of the patient's condition and response to therapy. For example, if asystole is detected on the monitor, CPR is continued while IV or intraosseous (IO) epinephrine is given. Additional medications (Table 25-4) may be indicated for the patient during and after resuscitation.

Each person on an effective Advanced Cardiac Life Support (ACLS) team, called a *CPR team* or sometimes a *code team*, has delineated roles. An efficient code team is characterized by individual members who are knowledgeable about their position and responsibilities. This ensures direct and clear lines of communication, effective team work, and a safe environment for the health care team and the patient (Panchal et al., 2019).

It is recommended practice to support family members of all patients who have had cardiac arrest and are undergoing resuscitation. In addition, there is clear support to have them present at the bedside if that is consonant with the patient's wishes. Written policies and procedures to support family presence during this time ought to be readily available for nurses and staff to easily access. Studies demonstrate family presence does not disrupt patient care, has no negative outcomes during the resuscitation event, and results in no adverse psychological effects (American Association of Critical-Care Nurses [AACN], 2016).

CPR is stopped when vital signs are detected or the patient responds. If the patient does not respond to interventions, the resuscitation effort may be stopped by the code team leader or other provider in charge of the resuscitation after options have been exhausted. Many factors are considered in the decision,

TABLE 25-4 Medications Used in Cardiopulmonary Resuscitation

Agent and Action	Indications	Nursing Considerations
Epinephrine—vasopressor used to optimize BP and cardiac output; improves perfusion and myocardial contractility	Given to patients in cardiac arrest caused by asystole, pulseless electrical activity, pulseless VT or VF	Administer 1 mg every 3–5 min by IV push or IO push. Follow peripheral IV administration with 20-mL saline flush and elevate extremity for 10–20 s.
Norepinephrine—vasopressor given to increase BP	Given for hypotension and shock	Administer 0.1–0.5 mcg/kg/min as IV infusion, preferably through a central line.
Dopamine—vasopressor given to increase BP and contractility	Given for hypotension and shock	Administer 5–10 mcg/kg/min as IV infusion, preferably through a central line.
Atropine—blocks parasympathetic action; increases SA node automaticity and AV conduction	Given to patients with symptomatic bradycardia (i.e., hemodynamically unstable with hypotension)	Administer 0.5-mg IV push; may repeat to dose of 3 mg, follow with saline flush.
Amiodarone—acts on sodium–potassium and calcium channels to prolong action potential and refractory period	Used to treat pulseless VT and VF unresponsive to shock delivery	Administer 300 mg IV; may give second dose of 150 mg in 3–5 min.
Sodium bicarbonate ($NaHCO_3$)—corrects metabolic acidosis	Given to correct metabolic acidosis that is refractory to standard advanced cardiac life support interventions (cardiopulmonary resuscitation, intubation, and respiratory management)	Administer initial dose of 1 mEq/kg IV/IO; then administer dose based on base deficit. Recognize that to prevent development of rebound metabolic alkalosis, complete correction of acidosis is not indicated.
Magnesium sulfate—promotes adequate functioning of cellular sodium–potassium pump	Given to patients with torsade de pointes, a type of VT	May administer 1–2 g diluted in 10 mL D_5W over 5–20 min.

AV, atrioventricular; BP, blood pressure; D_5W, dextrose 5% in water; IO, intraosseous; IV, intravenous; SA, sinoatrial; VF, ventricular fibrillation; VT, ventricular tachycardia.
Adapted from American Heart Association. (2019b). Part 7: Adult advanced cardiovascular life support. Resuscitation science: CPR and ECC guidelines. Retrieved on 12/9/2019 at: www.eccguidelines.heart.org/circulation/cpr-ecc-guidelines/part-7-adult-advanced-cardiovascular-life-support

such as the initiating arrhythmia, potential etiology, length of time for initiation of life support, the patient's response to treatment, and the patient's overall clinical status.

Follow-Up Monitoring and Care

The care provided to the patient following resuscitation is another determinant of survival (AHA, 2017). A 12-lead ECG is performed to detect any new ST segment elevation or myocardial ischemia (see Chapter 23). Continuous ECG monitoring and frequent blood pressure assessments are essential until hemodynamic stability is established and blood pressure is kept in a range to support adequate perfusion. Factors that precipitated the arrest such as arrhythmias or electrolyte or metabolic imbalances are identified and treated.

Following resuscitation and the return of spontaneous circulation, patients who are comatose may benefit from targeted temperature management (TTM). With TTM, core body temperature is decreased to 32° and 36°C (89.6° to 96.8°F) for at least 24 hours. This induced hypothermia decreases the cerebral metabolic rate and need for oxygen. Similarly, hyperthermic conditions, such as fever, are avoided to reduce oxygen demands (Callaway, Donnino, Fink, et al., 2015).

Advances in cardiac care, such as new techniques for effective resuscitation and postresuscitation hypothermia, have improved outcomes for patients. Research studies demonstrate better neurologic recovery and overall survival for patients when the correct algorithms and team dynamics are used after cardiac arrest; there is hope for even better outcomes in the future.

CRITICAL THINKING EXERCISES

1 ipc After recently being discharged from the hospital with an episode of acute decompensated HFrEF, a 62-year-old man presents to the cardiology clinic where you work. You note that this was the third hospitalization for this patient within the past 6 months. The patient is a widower, lives alone in a two-story home without a bathroom or bedroom on the first floor, and has been receiving disability benefits for several years. Identify how you intend to further assess the patient. What questions will you ask him? Which community-based resources and health care team members could be mobilized to facilitate his transition from the hospital-based setting to the community setting so that he avoids continued rehospitalization?

2 ebp You are a nurse educator working in a home health agency. You are tasked with presenting an educational session on HF self-care strategies. Using knowledge of evidence-based practice guidelines, list the most important topics to cover. Consider gender differences, medications, dietary recommendations, and suggestions for exercise.

3 pc A 75-year-old woman with an acute MI is admitted to the unit where you work as a staff nurse. You assess the patient and find that she is developing a cough, an increasing respiratory rate (32 breaths/min), and pink-tinged sputum. The patient seems agitated and becomes disoriented; she asks you why she is in the hospital. You call the rapid response team, and the following are prescribed: chest x-ray, arterial blood gases and basic metabolic panel, furosemide 40 mg IV, oxygen per nasal cannula to maintain a saturation greater than 94%. Place your planned interventions in priority order and explain your rationale.

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*Asterisk indicates nursing research.
**Double asterisk indicates classic reference.

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Resources

American Association of Heart Failure Nurses (AAHFN), www.aahfn.org
American College of Cardiology (ACC), www.acc.org
American Heart Association (AHA), www.heart.org
Heart Failure Society of America (HFSA), www.hfsa.org
National Heart, Lung, and Blood Institute, www.nhlbi.nih.gov