

# Cardiovascular Disorders



## Case Study 1 Heart Failure

**Difficulty:** Beginning

**Setting:** Emergency department, hospital

**Index Words:** heart failure (HF), cardiomyopathy, volume overload, patient education

**Giddens Concepts:** Fluid and Electrolyte Balance, Perfusion, Patient Education

**HESI Concepts:** Assessment, Fluid and Electrolyte, Perfusion, Patient Education

### ► Scenario

M.G., a “frequent flier,” is admitted to the emergency department (ED) with a diagnosis of heart failure (HF). She was discharged from the hospital 10 days ago and comes in today stating, “I just had to come to the hospital today because I can't catch my breath and my legs are as big as tree trunks.” After further questioning, you learn that she is strictly following the fluid and salt restriction ordered during her last hospital admission. She reports gaining 1 to 2 pounds every day since her discharge.

1. What error in teaching most likely occurred when M.G. was discharged 10 days ago?

*A breakdown of successful communication occurred regarding when to call with early weight gain. It is imperative that patients understand when to call their provider after being discharged from the hospital for exacerbated HF. Comprehensive patient education starting at admission is considered a standard of care and is mandated by The Joint Commission when care is provided to hospitalized patients. The goal of the discharge treatment plan is to facilitate successful patient self-management, minimize symptoms, and prevent readmission.*

### CASE STUDY PROGRESS

During the admission interview, the nurse makes a list of the medications M.G. took at home.

#### Chart View

##### Nursing Assessment: Medications Taken at Home

Enalapril (Vasotec)	5 mg PO bid
Pioglitazone (Actos)	45 mg PO every morning
Furosemide (Lasix)	40 mg/day PO
Potassium chloride	20 mEq/day PO

2. Which of these medications may have contributed to M.G.'s HF? Explain.

*Thiazolidinediones, such as pioglitazone, may increase the risk of HF and should not be used in patients with symptoms of HF. They commonly cause peripheral edema and weight gain (which are the result of both water retention and increased deposit of adipose tissue).*

## PART 1 MEDICAL-SURGICAL CASES

3. How do angiotensin-converting enzyme (ACE) inhibitors, such as enalapril (Vasotec), work to reduce HF? Select all that apply. ACE inhibitors:
- prevent the conversion of angiotensin I to angiotensin II.
  - cause systemic vasodilation.
  - promote the excretion of sodium and water in the renal tubules.
  - reduce preload and afterload.
  - increase cardiac contractility.
  - block sympathetic nervous system stimulation to the heart.

Answers: a, b, d

ACE inhibitors prevent the conversion of angiotensin I to angiotensin II, a potent vasoconstrictor. This results in systemic vasodilation, thereby reducing preload (reducing the volume of blood entering the left ventricle) and afterload (reducing the resistance to the left ventricular contraction) in patients with HF. ACE inhibitors do not promote the excretion of sodium and water, and they do not cause increased cardiac contractility or block the sympathetic nervous system to the heart.

## CASE STUDY PROGRESS

After reviewing M.G.'s medications, the physician writes the following medication orders.

## Chart View

## Medication Orders

Enalapril (Vasotec)	5 mg PO bid
Carvedilol (Coreg)	3.125 mg PO twice daily
Glipizide (Glucotrol)	10 mg PO every morning
Furosemide (Lasix)	80 mg intravenous push (IVP) now, then 40 mg/day IVP
Potassium chloride (K-Dur)	20 mEq/day PO

4. What is the rationale for changing the route of the furosemide (Lasix)?  
 M.G. is fluid overloaded and needs to decrease fluid volume in a short period. Intravenous administration is delivered directly into the vascular system, where it can start to work immediately. In HF, blood flow to the entire gastrointestinal (GI) system is compromised; therefore the absorption of orally ingested medications may be variable and take longer to work.
5. You administer furosemide (Lasix) 80 mg IVP. Identify three parameters you would use to monitor the effectiveness of this medication.
- Increased urine output
  - Daily weight, looking for weight loss
  - Intake and output (I&O)
  - Decreased dependent edema
  - Decreased shortness of breath, diminished crackles in the bases of the lungs, decreased work of breathing, and decreased O<sub>2</sub> demands
  - Decreased jugular venous distention (JVD)
6. What laboratory tests should be ordered for M.G. related to the order for furosemide (Lasix)? Select all that apply.
- Magnesium level
  - Sodium level
  - Complete blood count (CBC)

- d. Serum glucose level
- e. Potassium level
- f. Coagulation studies


Answers: a, b, d, e

Furosemide is a potent diuretic, especially when given via IVP, and may cause the loss of electrolytes such as magnesium, sodium, and potassium. These electrolytes will need to be supplemented if the levels are low. In addition, furosemide may increase serum glucose levels, which is an issue, considering that M.G. has diabetes. It is not necessary to monitor CBC or coagulation studies while the patient is on furosemide.

7. What is the purpose of the beta blocker carvedilol? It is given to:
- a. increase the contractility of the heart.
  - b. cause peripheral vasodilation.
  - c. increase urine output.
  - d. reduce cardiac stimulation from catecholamines.

Answer: d

Beta-blockers reduce or prevent stimulation of the heart from circulating catecholamines.

-  8. You assess M.G. for conditions that may be a contraindication to carvedilol. Which condition, if present, may cause serious problems if the patient takes this medication?
- a. Angina
  - b. Asthma
  - c. Glaucoma
  - d. Hypertension

Answer: b

Blocking of beta<sub>2</sub> receptors leads to a decrease in bronchial smooth muscle relaxation, or bronchoconstriction. Nonspecific (nonselective) beta-blocking drugs may precipitate bronchoconstriction and/or increased airway resistance. Therefore any preexisting respiratory condition such as asthma might be worsened by the concurrent use of any of these medications.

### CASE STUDY PROGRESS

One day later, M.G. has shown only slight improvement, and digoxin (Lanoxin) 125 mcg PO daily is added to her orders.

9. What is the action of the digoxin? Digoxin:
- a. causes systemic vasodilation.
  - b. promotes the excretion of sodium and water in the renal tubules.
  - c. increases cardiac contractility and cardiac output.
  - d. blocks sympathetic nervous system stimulation to the heart.

Answer: c

Digoxin works by increasing cardiac contractility and thus increasing cardiac output.

10. Which findings from M.G.'s assessment would indicate an increased possibility of digoxin toxicity? Explain your answer.
- a. Serum potassium level of 2.2 mEq/L
  - b. Serum sodium level of 139 mEq/L

## PART 1 MEDICAL-SURGICAL CASES

- c. Apical heart rate of 64 beats/minute
- d. Digoxin level 1.6 ng/mL

Answer: a

Low potassium levels can increase the potential for digoxin toxicity. M.G. is taking furosemide, a loop diuretic that excretes potassium as well as sodium and water. Potassium levels should be monitored carefully during digoxin therapy. The other findings are within normal limits.

11. When preparing to give the digoxin, you notice that it is available in milligrams (mg) not micrograms (mcg). Convert 125 mcg to mg.

$$125 \text{ mcg} = 0.125 \text{ mg}$$

If the student answers “.125 mg” the answer should be incorrect, because, per the Joint Commission “Do Not Use” list, the leading zero should not be omitted.

12. M.G.'s symptoms improve with intravenous diuretics and the digoxin. She is placed back on oral furosemide (Lasix) once her weight loss is deemed adequate for achievement of a euvolemic state. What will determine whether the oral dose will be adequate for discharge to be considered?

It is critical to provide the primary care provider with accurate, timely assessment data after the change from intravenous to oral diuretic therapy. One of the fluid management goals for patients with HF is to maintain a target weight. This is done by monitoring daily morning weight, keeping an accurate I&O, and recording subjective symptoms.

13. M.G. is ready for discharge. According to the mnemonic *MAWDS*, what key management concepts should be taught to prevent relapse and another admission?

The most essential aspect of teaching hospitalized patients is to focus on realistic key points.

Teaching should be aimed at successful communication of data to improve symptoms and prevent readmission, without overwhelming the learner. The five most essential concepts for patients with HF are included in *MAWDS* instructions.

*Medications:* Take as directed, do not skip a dose, and do not run out of medications.

*Activity:* Stay as active as you can while limiting your symptoms.

*Weight:* Weigh every morning. Call if you gain or lose 2 pounds overnight or are 5 pounds from your target weight.

*Diet:* Follow a low-salt diet, and limit fluids to less than 2 quarts or liters per day.

*Symptoms:* Know what symptoms to report to your provider; report early to prevent readmission.

14. After the teaching session, which statement by M.G. indicates a need for further education?
- a. “I will weigh myself daily and tell the doctor at my next visit if I am gaining weight.”
  - b. “I will not add salt when I am cooking.”
  - c. “I will try to take a short walk around the block with my husband three times a week.”
  - d. “I will use a pill calendar box to remind me to take my medicine.”

Answer: a

If she notices a weight gain, she needs to notify her physician right away, not at the next office visit. This is what brought her back to the hospital in the first place!

### CASE STUDY OUTCOME

After 3 days, the STOP Heart Failure Nurse calls M.G. to ask about her progress. M.G. reports that her weight has not changed since she has been home.



## Case Study 2 Hypertension

**Difficulty:** Beginning

**Setting:** Outpatient clinic

**Index Words:** coronary artery disease (CAD), hypertension (HTN), medications, patient education, laboratory values, lifestyle modification, risk factors, eye examinations

**Giddens Concepts:** Adherence, Perfusion, Patient Education

**HESI Concepts:** Adherence Behaviors, Perfusion, Patient Education

### ► Scenario

M.P. is a 65-year-old African American woman who comes to your clinic for a follow-up visit. She was diagnosed with hypertension (HTN) 2 months ago and was given a prescription for a thiazide diuretic but stopped taking it 2 weeks ago because “it made me dizzy and I kept getting up during the night to empty my bladder.” During today’s clinic visit, she expresses fear because her mother died of a cerebrovascular accident (CVA, stroke) at M.P.’s age, and M.P. is afraid she will suffer the same fate. She states, “I’ve never smoked and I don’t drink, but I am so afraid of this high blood pressure.” You review the data from her past clinic visits.

### Chart View

#### Family History

Mother, died at age 65 years of CVA

Father, died at age 67 years of myocardial infarction (MI)

Sister, alive and well, age 62 years

Brother, alive, age 70 years, has coronary artery disease (CAD), HTN, type II diabetes mellitus (DM)

#### Patient Past History

Married for 45 years, two children, alive and well, six grandchildren

Cholecystectomy, age 42 years

Hysterectomy, age 48 years

#### Blood Pressure Assessments

January 2: 150/92

January 31: 156/94 (Given prescription for hydrochlorothiazide [HCTZ] 25 mg PO every morning)

February 28: 140/90

1. According to the most recent guidelines from the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure, M.P.’s blood pressure (BP) falls under which classification?

**Stage 1 hypertension (defined as systolic BP from 140 to 159 mm Hg or diastolic BP from 90 to 99 mm Hg) on each of two or more office visits. Instructors may refer to the guidelines, the most recent information from the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 9).**

## PART 1 MEDICAL-SURGICAL CASES

2. What could M.P. be doing that is causing her nocturia?

She could be taking the HCTZ in the late afternoon or evening, instead of in the morning. Diuretics, such as HCTZ, should be taken in the morning so that the diuretic effects do not disturb sleep.

## CASE STUDY PROGRESS

During today's visit, M.P.'s vital signs are as follows: BP: 162/102; P: 78; R: 16; T: 98.2° F (36.8° C). Her most recent basic metabolic panel (BMP) and fasting lipids are within normal limits. Her height is 5 ft, 4 in, and she weighs 110 lb. She tells you that she tries to go on walks but does not like to walk alone and so has done so only occasionally.

3. What risk factors does M.P. have that increase her risk for cardiovascular disease?

Hypertension, physical inactivity, age over 65 years, postmenopausal status, family history of premature cardiovascular disease (mother died at age 65 years of CVA)

## CASE STUDY PROGRESS

Because M.P.'s BP continues to be high, the internist decides to put her on another drug and recommends that she try again with the HCTZ.

4. According to the JNC 8 national guidelines, what drug category or categories are recommended for M.P. at this time?

For patients of African descent who do not have diabetes mellitus or chronic kidney disease, the guidelines recommend calcium channel blockers (CCBs) and thiazide-type diuretics to be started before other antihypertensive drugs. If the CCBs and thiazide-type diuretics are not effective, the guidelines recommend a dosage adjustment and/or the addition of either an angiotensin-converting enzyme (ACE) inhibitor or an angiotensin receptor blocker. (Patients should not receive both an ACE inhibitor and an ARB.) Other medication classes, such as beta blockers and alpha-blockers, are considered after initial treatment with CCBs, thiazides, and ACE inhibitor/ARB is found to be ineffective. <http://www.ajmc.com/publications/evidence-based-diabetes-management/2014/jan-feb2014/the-jnc-8-hypertension-guidelines-an-in-depth-guide#sthash.96IRav0Q.dpuf> (accessed June 8, 2014).

5. M.P. goes on to ask whether there is anything else she should do to help with her HTN. She asks, "Do I need to lose weight?" Look up her height and weight for her age on a body mass index (BMI) chart. Is she considered overweight?

Depending on which BMI chart is used, M.P. would be considered either at optimal weight or even slightly underweight. She does not need to lose weight.

6. What nonpharmacologic lifestyle alteration measures might help M.P. control her BP? List two examples and explain.

- Limiting the salt in one's diet if one is salt sensitive. A good way to identify salt-sensitive people is to monitor BP on and off salt; if the BP decreases when salt is withheld, then the person is salt sensitive, and limiting salt might bring about a modest decline in BP. In people who are salt sensitive, the most effective technique has been the "no salt shaker" approach (i.e., don't add salt to food when cooking, and don't have a salt shaker on the table). Ultra-low-salt diets are, in general, ineffective and might even lead to an iodine deficiency.
- The DASH diet has been shown to be effective in lowering BP, usually within 14 days. The DASH diet is rich in fruits, vegetables, and low-fat dairy and is low in saturated fats. It is also higher than normal in potassium; magnesium; calcium; and vitamins D, E, and C. Dietary changes might have powerful cultural implications. Referral to a registered dietitian (RD) for meal planning and nutrition instruction can be beneficial.

- Reduced caffeine and alcohol intake can lower BP (note that M.P. does not drink alcohol).
- Routine aerobic exercise, such as walking, is also encouraged. Patients at risk for CAD should begin an exercise program under supervision and with the approval of their physician. It is important to start slowly and build up gradually. It is now recognized that any moderate activity is better than none. Studies have shown that long-term exercise compliance is better in individuals engaging in lower- to moderate-intensity exercise than in higher-intensity exercise. Although some patients may need to start walking as little as 3 to 5 minutes daily and increase by 1 to 2 minutes per week, the eventual goal is to walk briskly, without discomfort or shortness of breath, for 30 minutes five or six times per week. Patients taking beta-blockers cannot use normal exercise heart rate recommendations and require special guidelines. Here are some rules of thumb for exercise: (1) If you are stiff, sore, or exhausted as a result of the exercise, you have done something wrong or have done too much; and (2) if you are out of breath during exercise, you are doing too much. Slow down, enjoy, and live!
- Interventions such as stress management might work with some individuals.

### CASE STUDY PROGRESS

The internist decreases M.P.'s HCTZ dose to 12.5 mg PO daily and adds a prescription for benazepril (Lotensin) 5 mg daily. M.P. is instructed to return to the clinic in 1 week to have her blood work checked. She is instructed to monitor her BP at least twice a week and return for a medication management appointment in 1 month with her list of BP readings.

7. Why did the internist decrease the dose of the HCTZ?  
M.P. had been complaining of dizziness, which may be caused by orthostatic hypotension. The elderly might be more sensitive to hypotensive effects, and dosage adjustments can help reduce this problem.
8. You provide M.P. with education about the common side effects of benazepril, which can include which of these? Select all that apply.
  - a. Headache
  - b. Cough
  - c. Shortness of breath
  - d. Constipation
  - e. Dizziness

Answers: a, b, e

Headache, cough, and dizziness are common side effects of benazepril, as well as postural hypotension with position changes. The other responses are not correct.
9. It is sometimes difficult to remember whether one has taken one's medication. What techniques might you teach M.P. to help her remember to take her medications each day? Name at least two.
  - Use a day-of-the-week medication holder so she can see whether she has taken her medication for the day.
  - Make a checkmark on her calendar each day when she takes her pills.
  - Place her medication bottles in an area that is convenient for her so that she can see the medications and take them.



## PART 1 MEDICAL-SURGICAL CASES

10. After the teaching session, which statement by M.P. indicates a need for further instructions?
- “I need to rise up slowly when I get out of bed or out of a chair.”
  - “I will leave the salt shaker off the table and not salt my food when I cook.”
  - “It's okay to skip a few doses if I am feeling bad as long as it's just for a few days.”
  - “I will call if I feel very dizzy, weak, or short of breath while on this medicine.”

Answer: c

Skipping doses is not recommended because it can result in severe rebound hypertension. If she has questions about taking the drug or wants to stop taking it, she needs to contact her physician immediately.

## CASE STUDY PROGRESS

M.P. returns in 1 month for her medication management appointment. She tells you she is feeling fine and does not have any side effects from her new medication. Her BP, checked twice a week at the senior center, ranges from 132 to 136/78 to 82 mm Hg.

11. When someone is taking HCTZ and an angiotensin-converting enzyme (ACE) inhibitor, such as benazepril, what laboratory test results would you expect to be monitored?
- It is especially important to monitor potassium levels; the HCTZ can cause decreased levels, but ACE inhibitors, such as benazepril, can cause potassium levels to increase. Both drugs can cause decreased sodium and creatinine levels. HCTZ can increase serum glucose levels and decrease serum magnesium levels.

## Chart View

## Laboratory Test Results (Fasting)

Potassium	3.6 mEq/L
Sodium	138 mEq/L
Chloride	100 mEq/L
CO <sub>2</sub>	28 mEq/L
Glucose	112 mEq/L
Creatinine	0.7 mg/dL
Blood urea nitrogen (BUN)	18 mg/dL
Magnesium	1.9 mEq/L

12. What laboratory test results, if any, are of concern at this time?
- Overall, the results are within normal limits. The serum glucose is slightly elevated over 110 mEq/L. The elderly can have an increase in the normal range of glucose levels after age 50; however, remember that HCTZ can cause an increase in glucose levels.
13. You take M.P.'s BP and get 134/82 mm Hg. She asks whether these BP readings are okay. On what do you base your response?
- Compare these readings with the national standards and the goal to which you both agreed.



14. List at least three important ways you might help M.P. maintain her success.
- Remind her of the therapeutic goal you worked on with her.
  - Tell her you're proud of her! Therapeutic goals are individualized; however, these BP readings are improved and at the "prehypertensive" levels, according to the national guidelines. Tell M.P. that these readings are improving and that you'll pass them on to the physician.
  - Review her progress over the past months with her. This is an excellent way to reinforce adherence.
  - Remind her of the necessity of adhering to her treatment plan (because she is doing so well) and to keep checking her BP and taking her medications as directed.

#### CASE STUDY PROGRESS

M.P. tells you she was recently at a luncheon with her garden club and that most of those women take different BP pills than she does. She asks why their pills are different shapes and colors.

15. How can you explain the difference to M.P.?
- Start by explaining that many different drugs are used to treat HTN. The goal of her therapy is to find medications that adequately control her BP with few or no side effects. Each patient is individual in his or her medical history and tolerance for specific medications, so M.P. may find that her friends are on different medications.
  - Many drugs have generic versions, with different doses and formulations for each. All of these will have different shapes and colors, so the same drug may have several different appearances. This can be confusing, so patients should always double-check with their pharmacist to ensure there has been no mistake if their medication looks different.
16. During the visit, you ask M.P., "When was your last eye examination?" She answers, "I'm not sure, probably about 2 years ago. What does that have to do with my blood pressure?" What is your response?
- Hypertension can affect the vasculature of the eyes, and damage to the vessels may result in blindness if not controlled. Regular eye examinations, at least every year, are recommended to evaluate treatment effectiveness.

#### CASE STUDY OUTCOME

M.P. comes in for a routine follow-up visit 3 months later. She continues to do well on her daily BP drug regimen, with average BP readings of 130/78 mm Hg. She participates in a senior citizens' group walking program at the local mall. She admits she has not done as well with decreasing her salt intake but says she is trying.





## Case Study 3 Coronary Artery Disease: Prevention and Rehabilitation

**Difficulty:** Beginning

**Setting:** Outpatient cardiac rehabilitation center

**Index Words:** coronary artery disease (CAD), hypertension (HTN), angina, substance abuse, risk factors, family history, obesity assessment, family counseling

**Giddens Concepts:** Care Coordination, Health Promotion, Perfusion

**HESI Concepts:** Behaviors, Care Coordination, Health Promotion, Perfusion

### ► Scenario

You are a nurse at a freestanding cardiac prevention and rehabilitation center. Your new patient in risk-factor modification is B.T., a 41-year-old traveling salesman, who is married and has three children. He tells you that his work does not let him slow down. During a recent evaluation for chest pain, he underwent a cardiac catheterization procedure that showed moderate single-vessel disease with a 50% stenosis in the mid right coronary artery (RCA). He was given a prescription for sublingual (SL) nitroglycerin (NTG), told how to use it, and referred to your cardiac rehabilitation program for sessions 3 days a week. B.T.'s wife comes along to help him with healthy lifestyle changes. You take a nursing history, as indicated in the following.

### Chart View

#### Family History

Father died suddenly at age 42 of a myocardial infarction (MI)

Mother (still living) had a quadruple coronary artery bypass graft (CABG × 4) at age 52

#### Past History and Current Medications

Metoprolol (Lopressor) 25 mg PO every 12 hours

Aspirin (ASA) 325 mg per day PO

Simvastatin (Zocor) 20 mg PO every evening

#### Lifestyle Habits

Has smoked an average of 1<sup>1</sup>/<sub>2</sub> packs of cigarettes per day (PPD) for the past 20 years

Drinks an “occasional” beer and “a six-pack every weekend when watching football”

Dietary history: High in fried and fast foods because of his traveling

Exercise: “I don't have time to take walks.”

#### General Assessment

White Male

Weight 235 lb

Height 5 ft, 8 in

Waist circumference 48 in

Blood Pressure 148/88 mm Hg

Pulse 82 beats/min

Respiratory rate 18 breaths/min

Temperature 98.4° F (36.9° C)

## PART 1 MEDICAL-SURGICAL CASES

- Calculate B.T.'s smoking history in terms of pack-years.  
The number of pack-years is calculated by multiplying the average number of packs smoked per day by the number of years smoked. In this example, it is 1.5 packs  $\times$  20 years = 30 pack-years.
- There are several risk factors for coronary artery disease (CAD). For each risk factor listed, mark whether it is nonmodifiable or modifiable.
  - Age
  - Smoking
  - Family history of CAD
  - Obesity
  - Physical inactivity
  - Gender
  - Hypertension
  - Diabetes mellitus
  - Hyperlipidemia
  - Ethnic background
  - Stress
  - Excessive alcohol use
  - Nonmodifiable risk factors:** a. Age; c. Family history of CAD; f. Gender; j. Ethnic background. These are personal characteristics that cannot be altered or controlled.
  - Modifiable risk factors:** b. Smoking; d. Obesity; e. Physical inactivity; g. Hypertension; h. Diabetes mellitus; i. Hyperlipidemia; k. Stress; l. Excessive alcohol use. These are lifestyle choices that can be controlled or altered by the patient.
- Circle the nonmodifiable and modifiable risk factors that apply to B.T.  
You should have noted: B. Smoking; C. Family history of CAD; D. Obesity (fat distribution pattern); E. Physical inactivity; F. Gender (male); G. Hypertension; I. Hyperlipidemia; K. Stress.

## CASE STUDY PROGRESS

You review B.T.'s most recent laboratory results.

## Chart View

## Laboratory Testing (Fasting)

Total cholesterol	40 mg/dL
HDL	35 mg/dL
LDL	112 mg/dL
Triglycerides	178 mg/dL

- Which laboratory values are of concern at this time? Explain your answers.  
All of them. For those at risk for CAD, the fasting total cholesterol should be below 200 mg/dL, the HDL should be above 40 mg/dL, the LDL should be less than 100 mg/dL, and the triglycerides should be less than 150 mg/dL for men.
- B.T. asks you, "So, how is my 'good cholesterol' doing today?" Which is considered the "good cholesterol," and why? What do his HDL and LDL levels indicate to you?  
The HDL cholesterol is considered the "good" cholesterol because it has protective properties. It functions to remove the cholesterol from the peripheral tissues and transports it to the liver for excretion. B.T. has elevated LDL along with low levels of HDL. This combination makes him more at risk for an MI.

**CASE STUDY PROGRESS**

B.T. laughingly tells you he believes in the five all-American food groups: salt, sugar, fat, chocolate, and caffeine.

6. Identify health-related problems in this case description; the problem that is potentially life-threatening should be listed first.  
**High risk for sudden cardiac death (multiple risk factors such as family history, male gender); smoking; inactivity (sedentary lifestyle); obesity; stressful lifestyle; HTN; hyperlipidemia; and a high-fat, low-fiber diet.**
7. Of all of B.T.'s behaviors, which one is the most significant in promoting cardiac disease?  
**Without question, his smoking is the riskiest. According to the American Heart Association, a smoker's risk of developing CAD is two to four times higher than that of nonsmokers. Those who smoke a pack of cigarettes per day have more than twice the risk of nonsmokers for MI.**
8. What interventions would you recommend to assist B.T. in addressing this behavior?  
**Use your best powers of persuasion to get B.T. to work on smoking cessation. This is his biggest risk factor and affects not only his health but also the health of his wife and children (children exposed to cigarette smoke are more likely to have asthma and other diseases). Give B.T. and his wife a list of smoking cessation classes, and explain how stopping smoking will reduce his risk for heart attack. Assure him that, although it will not be easy, he can do it. He can consult his health care provider about pharmacologic aids for smoking cessation, such as nicotine patches or gum, varenicline (Chantix), and bupropion (Zyban), that might be helpful. The American Heart Association, the American Lung Association, and the American Cancer Society all have excellent literature and programs on smoking cessation.**
9. Because B.T. has several other problems, how will you determine what the priorities are that you need to address with B.T.?  
**The most important problem is the one B.T. and his wife are willing to work on, the one they identify as most important. This helps cement their commitment to behavioral change. For example, they decide he needs to exercise. Inform him that cardiac rehabilitation will help him become more active and do it safely—he might even enjoy it! You may help him change his outlook because this is something he thinks is important. Praise his wife for being supportive in helping both of them live a healthier lifestyle.**
10. Name a second problem you would work with B.T. to change. Identify an appropriate strategy to resolve the problem.  
**Patient preference: Once again, find out from B.T. and his wife what they would like to work on.**
  - **Obesity: Do not assume that anyone is cooking these days—more and more people are eating food from drive-through windows. If patients eat out a lot, refer them to a website such as [www.calorieking.com](http://www.calorieking.com) for an education on restaurant food, portion sizes, and calories, or give them a pamphlet from the American Heart Association on risk of obesity and cardiac disease, and then refer them to medical nutrition therapy (MNT). Inform them that eating low-fat meals does not mean that they have to give up tasty foods. If B.T.'s wife does the cooking, give her a few low-fat recipes that taste good, and encourage her to swap recipes with other people in cardiac rehabilitation. Focus your teaching around a low-fat diet to decrease obesity and hyperlipidemia risks. There are many excellent books and magazines available on tasty, low-fat healthy eating.**
  - **Stress: Find out what helps B.T. relax. Help him analyze whether his current techniques are healthy. For example, drinking a lot of beer is not a healthy technique. If necessary, teach positive relaxation techniques that he can use when he is on the road.**

## PART 1 MEDICAL-SURGICAL CASES

11. B.T.'s wife takes you aside and tells you, "I'm so worried for B. I grew up in a really dysfunctional family where there was a lot of violence. B. has been so good to the kids and me. I'm so worried I'll lose him that I have nightmares about his heart stopping. I find myself suddenly waking up at night just to see if he's breathing." How are you going to respond?
- Thank her for sharing with you. Acknowledge that heart disease in a loved one can be a very frightening thing.
  - Suggest that she practice stress-relaxation techniques with him.
  - Ask whether she would like to talk to someone about her anxiety.

## CASE STUDY PROGRESS

Six weeks after you start working with B.T., he admits that he has been under a lot of stress. He is walking on the treadmill and rubs his chest and says, "It feels really heavy on my chest right now." You feel his pulse and note that his skin is slightly diaphoretic and that he is agitated and appears to be anxious.

12. What is the first action you are going to do? What other information will you obtain? Explain.
- Have B.T. stop any activity and sit or lie down because you want to decrease the workload on his heart and decrease his body's need for oxygen. You will also check his vital signs and ask whether he has any SL NTG tablets with him.
13. B.T. is still uncomfortable, and he has an unopened bottle of sublingual nitroglycerin (SL NTG) tablets. His blood pressure is 158/98, and his pulse is 122. You decide to give him one tablet. After 5 minutes, which is the appropriate action to take?
- If the chest discomfort is relieved, call 911.
  - If the chest discomfort is not relieved, give another SL NTG tablet, and wait 5 minutes more.
  - If the chest discomfort is not relieved, have someone else call 911 while you give B.T. another SL NTG tablet.
  - If the chest discomfort is not relieved, obtain a 12-lead electrocardiogram (ECG) to look for ischemic changes, and call 911.
- Answer: c
- According to current guidelines, if the chest pain or discomfort is not relieved in 5 minutes, after one dose of SL NTG, call 911 immediately. The patient can take one more tablet while awaiting emergency care, and a third tablet 5 minutes later, but no more than three tablets total. These guidelines reflect the fact that angina pain that does not respond to NTG might indicate that an MI is occurring.
14. What other actions will you take at this time?
- Continue to monitor his vital signs, and consider checking a 12-lead ECG (if available) to look for ischemic changes. Keep him quiet, and reassure him that you will stay with him.
15. Five minutes after the first NTG tablet, B.T. states that the discomfort is still there and only slightly relieved. Explain what you can expect to be doing while waiting for emergency medical system (EMS) personnel to arrive.
- Have one nurse call 911 and request emergency transport to the nearest emergency department (ED) while you stay with B.T.
  - Have B.T. chew two low-dose (81 mg, or "baby") aspirin tablets, if available.
  - Following the department protocols, while you are waiting for the medics, start 2 to 4 L of O<sub>2</sub>/NC and establish intravenous (IV) access, in case IV medications have to be administered.

- Run a 12-lead ECG or rhythm strip to look for dysrhythmias and ischemic changes. Run a long rhythm strip. If B.T. needs to be transported by the paramedics to the ED, it may be valuable to the medical personnel at the hospital.
- Continue to observe B.T. carefully and monitor his vital signs, reassure him, and make him as comfortable as possible.
- Notify B.T.'s attending physician and his wife.



16. After taking the second NTG SL tablet, B.T. complains of a “terrible headache” and worries that he is getting worse. What is happening, and what should you tell him?  
Headache is a common side effect of NG therapy because of vasodilation. You need to reassure him that this is a side effect of the NTG and that he is not getting worse. Encourage him to rest quietly as the NTG may also cause a drop in blood pressure (orthostatic changes) if he tries to get up.

#### CASE STUDY OUTCOME

B.T. is transported to the emergency department of a local hospital and undergoes another cardiac catheterization with coronary stent placement.







## Case Study 4 Coronary Artery Disease and Heart Failure

**Difficulty:** Intermediate

**Setting:** Outpatient clinic

**Index Words:** coronary artery disease (CAD), heart failure (HF), laboratory values, medications, therapeutic nutrition, echocardiogram

**Giddens Concepts:** Care Coordination, Perfusion, Patient Education

**HESI Concepts:** Assessment, Care Coordination, Perfusion, Patient Education

### ► Scenario

You are working in the internal medicine clinic of a large teaching hospital. Today your first patient is 70-year-old J.M., a man who has been coming to the clinic for several years for management of coronary artery disease (CAD) and hypertension (HTN). A cardiac catheterization done a year ago showed 50% stenosis of the circumflex coronary artery. He has had episodes of dizziness for the past 6 months and orthostatic hypotension, shoulder discomfort, and decreased exercise tolerance for the past 2 months. On his last clinic visit 3 weeks ago, a chest x-ray (CXR) examination revealed cardiomegaly, and a 12-lead electrocardiogram (ECG) showed sinus tachycardia with left bundle branch block (LBBB). You review J.M.'s morning blood work and initial assessment.

### Chart View

#### Laboratory Results

##### Chemistry

Sodium	142 mEq/L
Chloride	95 mEq/L
Potassium	3.9 mEq/L
Creatinine	0.8 mg/dL
Glucose	82 mg/dL
BUN	19 mg/dL

##### Complete Blood Count

WBC	5400/mm <sup>3</sup>
Hgb	11.5 g/dL
Hct	37%
Platelets	229,000/mm <sup>3</sup>

#### Initial Assessment

Complains of increased fatigue and shortness of breath, especially with activity, and “waking up gasping for breath” at night, for the past 2 days.

##### Vital Signs

Temperature	97.9° F (36.6° C)
Blood pressure (BP)	142/83 mm Hg
Heart rate	105 beats//min
Respiratory rate	18 breaths/min

## PART 1 MEDICAL-SURGICAL CASES

- As you review these results, which ones are of possible concern, and why?  
 The blood pressure and pulse are slightly elevated, with several possibilities, including worsening of J.M.'s CAD, HTN, or possibly heart failure (HF). More testing is needed to verify. His Hgb and Hct are slightly decreased, and further testing is needed to determine whether an iron deficiency or vitamin B12 deficiency exists.
- Knowing his history and seeing his condition this morning, what further questions are you going to ask J.M. and his daughter?  
*Activity:* What makes you tired? Do you sometimes feel like you can't get your breath?  
*Diet:* What are your favorite foods? What did you eat within the past 48 hours? The biggest problem usually is not added table salt. Many foods such as chips, peanuts, pizza, pickles, canned soups, turkey dressing, and ham contain salt. Have you recently eaten any of these? Try to relate salt intake to symptoms that started 2 days ago. Also ask about microwave meals, lunch meats, canned foods, fast foods or restaurant foods, and entrées.  
*Sleep:* How many pillows do you sleep on at night? Do you wake up during the night with shortness of breath?  
*Fluid retention:* Have you gained weight, or has your urinary output decreased over the past few days? Have you had trouble getting your shoes on? Do you weigh yourself daily?  
*Lungs:* Do you have a cough? Do you cough anything up or is it productive? If so, describe the sputum. What happens when you wake up at night, "gasping" for breath? How often does this happen? How many pillows do you use at night when sleeping?  
*Cardiac rhythm:* Are you having any strange feelings in your chest (palpitations)? Does your heart race at times or flutter, skip beats, pause, or thump? Palpitations vary widely, as do individual descriptions. Have you experienced dizziness, lightheadedness, or passing out?  
*Chest pain:* Are you having any discomfort or numbness in your chest, back, shoulders, arms, hands, or neck and jaws? If so, describe the sensations.  
*Smoking history:* Have you ever smoked? Do you smoke now? If so, how many packs a day do you smoke?  
*Occupational history:* This question is critical with respect to smoking history. Watch for occupational (or wartime) experience in mining, shipyard work, toxin exposure, or pulmonary irritant exposure (e.g., asbestos, Agent Orange). Combined with smoking, these make a lethal combination for the heart as well as lungs.

## CASE STUDY PROGRESS

J.M. tells you he becomes exhausted and has shortness of breath climbing the stairs to his bedroom and has to lie down and rest ("put my feet up") at least an hour twice a day. He has been sleeping on two pillows for the past 2 weeks. He has not salted his food since the physician told him not to because of his high blood pressure, but he admits having had ham and a small bag of salted peanuts 3 days ago. He states that he stopped smoking 10 years ago. He denies having palpitations but has had a constant, irritating, nonproductive cough lately.

- You think it's likely that J.M. has heart failure (HF). From his history, what do you identify as probable causes for his HF?  
*HTN:* Chronic HTN can require the heart to pump hard against the resistance of the vessels. This results in cardiac muscle hypertrophy (the cardiomegaly seen on his CXR study).  
*CAD:* Ischemic myocardium is not able to produce adequate stroke volumes.  
*Anemia:* Anemia decreases the availability of oxygen to all tissues of the body, and the heart responds by increasing blood flow (stroke volume and/or heart rate), thereby increasing the oxygen demands of the heart and contributing to myocardial ischemia. However, keep in mind that hemodilution (from fluid volume excess) might cause his Hct to appear low.

4. You are now ready to do your physical assessment. For each potential assessment finding for HF, indicate whether the finding indicates left-sided HF (L) or right-sided HF (R).
- \_\_\_ 1. Fatigue, weakness, especially with activity
  - \_\_\_ 2. Jugular (neck) vein distention
  - \_\_\_ 3. Dependent edema (legs and sacrum)
  - \_\_\_ 4. Hacking cough, worse at night
  - \_\_\_ 5. Enlarged liver and spleen
  - \_\_\_ 6. Exertional dyspnea
  - \_\_\_ 7. Distended abdomen
  - \_\_\_ 8. Weight gain
  - \_\_\_ 9. S<sub>3</sub>/S<sub>4</sub> gallop
  - \_\_\_ 10. Crackles and wheezes in lungs
- Assessment findings for left-sided HF: 1, 4, 6, 9, 10
  - Assessment findings for right-sided HF: 2, 3, 5, 7, 8

### Chart View

#### Medication Orders

Enalapril (Vasotec) 10 mg PO twice a day  
 Furosemide (Lasix) 20 mg PO every morning  
 Carvedilol (Coreg) 6.25 mg PO twice a day  
 Digoxin (Lanoxin) 0.5 mg PO now, then 0.125 mg PO daily  
 Potassium chloride (K-Dur) 10 mEq tablet PO once a day

### CASE STUDY PROGRESS

The physician confirms your suspicions and indicates that J.M. is experiencing symptoms of early left-sided heart failure. A two-dimensional (2D) echocardiogram is ordered. Medication orders are written.

5. For each medication listed, identify its class and describe its purpose for the treatment of HF.
- Enalapril (Vasotec):* Angiotensin-converting enzyme (ACE) inhibitor. ACE inhibitors prevent sodium and water resorption by inhibiting aldosterone secretion, resulting in diuresis, which decreases blood volume and blood return to the heart. As a result, the workload of the heart is decreased.
  - Furosemide (Lasix):* Loop diuretic. Loop diuretics are given to decrease fluid volume (preload).
  - Carvedilol (Coreg):* Nonspecific beta-blocker. Beta-blockers work to reduce or to block sympathetic nervous system stimulation of the heart and of the heart's conduction system (cardioprotective action). As a result, the heart rate is reduced.
  - Digoxin (Lanoxin):* Cardiac glycoside and inotropic drug. This drug increases myocardial contractility (positive inotropic effect), resulting in enhanced cardiac efficiency and output.
  - Potassium chloride (K-Dur):* Electrolyte supplement. This supplement is given to replace potassium that might be lost with diuretic therapy.
6. When you go to remove the medications from the automated dispensing machine, you see that carvedilol (Coreg CR) is stocked. Will you give it to J.M.? Explain.
- No! Coreg CR is a controlled-release formulation, which is released slowly, and the dosages are different. The "plain" Coreg is an immediate-release formulation. The two are not interchangeable.**

## PART 1 MEDICAL-SURGICAL CASES

7. As you remove the digoxin tablet from the automated medication dispensing machine, you note that the dose on the tablet label is 250 mcg. How many tablets would you give?

You would give two tablets.

$$250 \text{ mcg} = 0.25 \text{ mg}$$

$$0.25 \text{ mg} / 1 \text{ tablet} = 0.5 \text{ mg} / x$$

$$0.25x = 0.5; x = 2 \text{ tablets}$$

Be sure students do not omit the leading zero before the decimal point (.25 mg) and they do not add a trailing zero after the 5 (0.250 mg).

8. Based on the new medication orders, which blood test or tests should be monitored carefully? Explain your answer.

Potassium levels need to be monitored, for several reasons. The diuretic causes potassium to be excreted along with sodium and water, thus the potassium supplement is ordered. However, the ACE inhibitor causes retention of potassium and can lead to hyperkalemia. Last, patients who are taking digoxin need to have potassium levels monitored as well as periodic digoxin levels. If potassium levels get low, the hypokalemia can make the patient more susceptible to digoxin toxicity. Digoxin levels must be monitored carefully because digoxin toxicity can lead to serious complications.

9. When you give J.M. his medications, he looks at the potassium tablet, wrinkles his nose, and tells you he “hates those horse pills.” He tells you a friend of his said he could eat bananas instead. He says he would rather eat a banana every day than take one of those pills. How will you respond?

- Use empathy and humor. Tell him that sounds good, but to get as much potassium from a banana as he would from the potassium tablet, he would have to eat a 4-foot long banana every day!
- Tell him there are other ways the physician can order the potassium, such as in a liquid form or a powder form that is dissolved in liquid. If J.M. would prefer, ask the physician for an order of a different formulation.

10. The 2D echocardiogram shows that J.M.'s left ventricular ejection fraction (EF) is 49%. Explain what this test results mean with regard to J.M.'s heart function.

The *ejection fraction* refers to the amount of blood that is pumped out of the heart's ventricle with each heartbeat and is measured as a percentage. EF is generally measured only in the left ventricle (LV). An LV EF of 55% or higher is considered within normal range. J.M.'s EF is decreased and reflects the weakening of his heart muscle as a result of the HF.

## CASE STUDY PROGRESS

This is J.M.'s first episode of significant HF. Before he leaves the clinic, you want to teach him about life-style modifications he can make and monitoring techniques he can use to prevent or minimize future problems.

11. List five suggestions you might make and the rationale for each.
- Gradually increase and pace your activities to decrease the work requirements and oxygen demand of the heart.
  - Minimize stress to reduce sympathetic nervous system response to increased workload of the heart.
  - Avoid hot or cold environments; both increase cardiac demand.
  - Learn to take your pulse, and call your physician if your pulse is less than 50 beats/min, greater than 100 beats/min, or very irregular. Very slow, very rapid, or irregular heart rates can exacerbate HF.

- Weigh yourself daily to monitor for fluid retention. Report a 2- to 5-pound weight gain over 1 to 4 days to your physician. Sudden weight gain indicates fluid retention.
  - Carefully follow your salt-restricted diet to minimize fluid retention. Limit oral fluid intake to 2 L daily.
  - Take your medications faithfully, and call your health care provider immediately before stopping your medication.
  - If any new or worsening symptoms occur, notify your health care provider immediately.
12. You tell J.M. that the combination of high-sodium foods he had during the past several days might have contributed to his present episode of HF. He looks surprised. J.M. says, “But I didn’t add any salt to them!” To what health care professional could J.M. be referred to help him understand how to prevent future crises? State your rationale.
- J.M. obviously does not understand that many foods contain high amounts of sodium. Some patients might associate sodium with added salt only. J.M. needs help in understanding what foods are “safe.” A registered dietitian could provide medical nutrition therapy (MNT) and assist in low-sodium modifications, how to read food labels, and how to use spices to make tasty meals. He needs to limit daily sodium intake to 2 to 3 g, and limit daily fluid intake to 2 L.
13. You also include teaching about digoxin toxicity. When teaching J.M. about the signs and symptoms of digoxin toxicity, which should be included? Select all that apply.
- a. Dizziness when standing up
  - b. Visual changes
  - c. Loss of appetite or nausea
  - d. Increased urine output
  - e. Diarrhea

Answers: b, c, e

Signs and symptoms of digoxin toxicity include anorexia, nausea, vomiting, diarrhea, and visual disturbances, such as flickering lights, blurred vision, or the perception of green or yellow halos around lights.

#### CASE STUDY OUTCOME

J.M.'s condition improves after 5 days of treatment, and he is discharged to home. He has a follow-up appointment with a cardiologist in 2 weeks. He is enrolled in the clinic's STOP Heart Failure program, and a heart failure nurse will contact him in a few days to check his progress.







## Case Study 5 Coronary Artery Disease and Pacemakers

**Difficulty:** Intermediate

**Setting:** Hospital, outpatient cardiac rehabilitation

**Index Words:** coronary artery disease (CAD), hypertension (HTN), angina, lifestyle modification, medications, laboratory values, assessment, risk factors, pacemaker, ECG strip, atrial fibrillation, graded exercise (stress) test

**Giddens Concepts:** Caregiving, Perfusion, Patient Education

**HESI Concepts:** Assessment, Caregiving, Perfusion, Patient Education

### ► Scenario

It is midmorning on the cardiac unit where you work, and you are getting a new patient. G.P. is a 60-year-old retired businessman who is married and has three grown children. As you take his health history, he tells you that he began feeling changes in his chest about 10 days ago. He has hypertension (HTN) and a 5-year history of angina pectoris. During the past week, he has had frequent episodes of mid-chest discomfort. The chest pain responds to nitroglycerin (NTG), which he has taken sublingually about 8 to 10 times over the past week. During the week, he has also experienced increased fatigue. He states, "I just feel crappy all the time." A cardiac catheterization done several years ago revealed 50% stenosis of the right coronary artery (RCA) and 50% stenosis of the left anterior descending (LAD) coronary artery. He tells you that both his mother and his father had coronary artery disease (CAD). He is currently taking amlodipine (Norvasc), metoprolol (Lopressor), atorvastatin (Lipitor), and aspirin 81 mg/day.

1. What other information are you going to obtain about his episodes of chest pain?
  - Are they accompanied by other signs and symptoms, such as nausea or vomiting, diaphoresis, shortness of breath, dizziness, weakness, palpitations, or anxiety?
  - Do they occur during exercise, after eating a large meal, in cold weather, or during periods of stress? Or do the episodes of chest pain occur during rest?
  - What is the quality of the pain? Ask him to describe the sensation in his own words. Ask him to rate the chest pain on a scale of 1 to 10.
  - How long do the episodes last?
  - Does the pain radiate to other areas of the body?
  - How many NTG tablets does he take before the chest pain is relieved?
2. What are common sites for radiation of ischemic cardiac pain?
 

Epigastric area, arms and hands (especially left), back (intrascapular area), shoulders, neck, and jaw
3. You know that G.P. has atherosclerosis of the coronary arteries. You need to know his risk factors for CAD to plan teaching for lifestyle modifications. What will you ask him about?
 

*Family history:* Ask for specific information regarding his relatives who had CAD.

*Weight:* Obesity is a serious risk factor; calculate his body mass index (BMI) and waist-hip ratio.

*Smoking history*

*Blood pressure:* According to the new JNC 8 guidelines, for a person age 60 or older, the goal is systolic blood pressure (SBP) less than 150 mm Hg and diastolic blood pressure (DBP) less than 90 mm Hg.

*Diet:* Ask about his favorite foods. For example, ask, "What did you eat for breakfast, lunch, and dinner yesterday and today?"

*Stress:* Find out what stressors he has in his life and what he does when he is feeling stressed.

*Exercise:* Does he exercise? If so, what kind of exercises does he do? Does he have angina or become short of breath when he exercises or does yard work?

*Drug use:* Has he taken any street drugs or abused prescription medication in the past? If yes, take a complete drug history: type, quantity, frequency, route.

## PART 1 MEDICAL-SURGICAL CASES

4. Although he has been taking sublingual nitroglycerin (SL NTG) for a long time, you want to be certain he is using it correctly. Which actions are correct when taking SL NTG for chest pain? (Select all that apply.)
- Stop the activity and lie or sit down.
  - Call 911 immediately.
  - Call 911 if the pain is not relieved after taking one SL tablet.
  - Call 911 if the pain is not relieved after taking three SL tablets, 5 minutes apart.
  - Chew the tablet slowly then swallow.
  - Place the NTG tablet under the tongue.

Answers: a, c, f

SL NTG should be placed under the tongue and allowed to dissolve naturally and not swallowed until the drug is entirely dissolved. G.P. should sit or lie down on first indication of anginal pain and place the tablet under his tongue. Lying down will reduce hypotensive effects. According to the latest American Heart Association guidelines, 911 (the emergency medical system [EMS]) should be called if the pain is not relieved after *one* SL tablet. Pain that is not relieved by one tablet may be indicative of acute myocardial infarction (MI) or severe coronary insufficiency.

5. You review the use and storage of SL NTG with G.P. Which statement by G.P. indicates a need for further education? Explain your answer.
- “I will discard any open bottle of nitroglycerin after a year.”
  - “I will not store other pills in the nitroglycerin bottle.”
  - “I carry the tablets with me at all times.”
  - “I will keep the pills in their original brown bottle.”

Answer: a

Tablets should be kept tightly sealed in their original brown bottle to protect them from heat, moisture, and light. An open bottle of tablets should not be kept longer than 6 months; an unopened bottle should be stored at room temperature until the expiration date, then discarded. No other pills should be placed in this bottle. He should carry the tablets with him at all times for emergency use.

## CASE STUDY PROGRESS

When you first admit G.P., you place him on telemetry and observe his cardiac rhythm.

6. Identify the rhythm:



Answer: Atrial fibrillation

7. Explain the primary complication that could occur if this heart rhythm were not treated.  
Clots (thrombi) may develop in the fibrillating atria as a result of stasis of the blood. These clots may travel as emboli to the brain, causing a stroke, or to the lungs, causing pulmonary emboli.
8. Review G.P.'s history. What conditions may have contributed to the development of this dysrhythmia?  
Atrial fibrillation often occurs in patients with CAD and HTN.
9. You review G.P.'s laboratory test results and note that all of them are within normal range, including troponin and creatinine phosphokinase (CPK) levels. His potassium level is 4.7 mEq/L. Given this and his current dysrhythmia, what is the likely cause of the symptoms he has been experiencing this past week?  
The atrial fibrillation causes decreased cardiac output, including reduced perfusion of the cardiac muscle. This, along with his existing CAD, could lead to his angina episodes as a result of cardiac ischemia. The normal troponin and CPK levels indicate that damage to the heart muscle (infarction) has not yet occurred.

**CASE STUDY PROGRESS**

Within the hour, G.P. converts with intravenous diltiazem (Cardizem) to sick sinus syndrome with long sinus pauses that cause lightheadedness and hypotension.

10. What risks does the new rhythm pose for G.P.? Explain the reasons for your answers.
- Syncope and falls because of the hypotension and lightheadedness
  - Increased anginal episodes and more serious dysrhythmias because of decreased perfusion to the heart
  - Confusion, altered level of consciousness because of decreased perfusion to the brain
  - Heart failure (HF) because of inadequate heart rate during bradycardia and inadequate ventricular filling during tachycardia

**CASE STUDY PROGRESS**

Because G.P.'s dysrhythmia is causing unacceptable symptoms, he is taken to surgery and a permanent DDDR pacemaker is placed and set at a rate of 70 beats/min.

11. What does the code *DDDR* mean?  
DDDR pacing is used for patients with a symptomatic bradycardia in which the atrium can be stimulated by a pacemaker but atrioventricular conduction is, or possibly might become, unreliable. The first *D* indicates the heart chamber paced, meaning dual pacing, because both the atrium and ventricle are paced. The second *D* indicates the chamber sensed, meaning dual sensing, because both the atrium and ventricle are sensed. The third *D* indicates how the pacemaker will respond to the patient's own activity; *D* indicates dual response to sensing, either triggered or inhibited. The *R* indicates rate-responsive pacing.





12. The pacemaker insertion surgery places G.P. at risk for several serious complications. List three potential problems that you will monitor for as you care for him.  
*Infection:* To prevent infection or irritation of the pacemaker site, use sterile technique with dressing changes.  
*Pacemaker dysfunction:* The pacemaker can fail to pace (initiate an electrical impulse), fail to sense (be responsive to the patient's own cardiac activity), or fail to capture (stimulate a ventricular contraction). All of these problems can result in dysrhythmias, ineffective cardiac function, and symptoms for the patient.

## PART 1 MEDICAL-SURGICAL CASES

*Perforation of the endocardium:* The result could be cardiac tamponade. He might experience sharp chest pain on inspiration and excessive hiccups, increased heart rate, decreased blood pressure (BP), and shortness of breath.

*Hematoma at the incision site:* You would see evidence of increased ecchymosis, swelling, and tenderness at the incision site.

*Pneumothorax:* He would experience sudden, sharp chest pain and shortness of breath.

-  13. G.P. will need some education regarding his new pacemaker. What information will you give him before he leaves the hospital?
- Call the physician if you have signs or symptoms (S/S) of infection, such as fever or excessive redness, swelling, unusual pain, or drainage at the incision site.
  - Restrict arm lifting movements or exercises for 2 to 3 weeks after surgery. This applies only to the arm on the same side of the body as the surgical site. Frequently, patients are asked to wear a sling and swath to prevent arm movement.
  - Call the physician if you have any of the following S/S of pacemaker malfunction: dizziness, passing out, palpitations, chest pain, and unusual weight gain.
  - Observe safety precautions by avoiding contact sports, avoiding pressure on the incision, wearing a medical alert bracelet or necklace, carrying a pacemaker ID card, and avoiding high-voltage electrical and magnetic equipment.
14. G.P.'s wife approaches you and anxiously inquires, “My neighbor saw this science fiction movie about this guy who got a pacemaker and then he couldn't die. Is that for real?” How are you going to respond to her?
- Do not laugh! Patients and their families sometimes hear bizarre stories about “high-tech” health care issues. It is fortunate she felt she could ask you this question. Keep in mind that if she asked you about it, she probably worried about it a great deal.
  - Reassure her that it might have made a great plot for a movie, but it's not a “real” situation.
  - Explain to her the pacemaker gives off only “mini electrical signals” to make the heart beat regularly.
  - This might be a good time to ask whether she and G.P. have discussed and done anything about health care power-of-attorney and advance directives for each other.
-  15. G.P. and his wife tell you they have heard that people with pacemakers can have their hearts stop because of microwave ovens and cell phones. Where can you help them find more information?
- The manufacturer of the pacemaker should also provide information on the vulnerability of its product. Information might vary with the different devices.
  - The American Heart Association is a good source of information and literature with the most recent warnings and standards.

**CASE STUDY PROGRESS**

After discharge, G.P. is referred to a cardiac rehabilitation center to start an exercise program. He will be exercise tested, and an individualized exercise prescription will be developed for him, based on the results of the exercise test.

16. What information will be obtained from a graded exercise (stress) test, and what is included in an exercise prescription?
- G.P.'s cardiorespiratory responses (pulse, BP, respiratory gases [oxygen and carbon dioxide], and perceived exertion) to specific workloads will be evaluated to ensure that he can safely exercise in the intensity range prescribed for him.

- His resting (lowest) and peak (highest) exertional heart rates will be incorporated into the exercise prescription.
- The exercise prescription will start him at a workload that is not dangerous or emotionally threatening to him (e.g., slow and easy).
- Just as medications are prescribed (type, dose, time, route), exercise for cardiac patients should be prescribed in these terms:
  - Type of exercise (what kind)
  - Intensity of exercise (how hard)—usually as pulse or perceived exertion
  - Frequency of exercise (how often)—usually beginning at 3 days per week
  - Duration of exercise (how long)—usually measured in minutes or distance
- What is the safest level of activity for G.P., and what problems could develop at what intensity?





## Case Study 6 Peripheral Artery Disease

**Difficulty:** Beginning

**Setting:** Private clinic

**Index Words:** claudication, ankle-brachial index (ABI), risk factor modification, patient teaching

**Giddens Concepts:** Health Promotion, Pain, Patient Education, Tissue Integrity

**HESI Concepts:** Assessment, Health Promotion, Pain, Patient Education, Tissue Integrity

### ► Scenario

S.P. is a 68-year-old retired painter who is experiencing right leg calf pain. The pain began approximately 2 years ago but has become significantly worse in the past 4 months. The pain is precipitated by exercise and is relieved with rest. Two years ago, S.P. could walk two city blocks before having to stop because of leg pain. Today, he can barely walk across the yard. S.P. has smoked two to three packs of cigarettes per day (PPD) for the past 45 years. He has a history of coronary artery disease (CAD), hypertension (HTN), peripheral artery disease (PAD), and osteoarthritis. Surgical history includes quadruple coronary artery bypass graft (CABG × 4) 3 years ago. He has had no further symptoms of cardiopulmonary disease since that time, even though he has not been compliant with the exercise regimen his cardiologist prescribed, continues to eat anything he wants, and continues to smoke two to three PPD. Other surgical history includes open reduction internal fixation of a right femoral fracture 20 years ago.

S.P. is in the clinic today for a routine semiannual follow-up appointment with his primary care provider. As you take his vital signs, he tells you that in addition to the calf pain, he is experiencing right hip pain that gets worse with exercise, the pain doesn't go away promptly with rest, some days are worse than others, and his condition is not affected by a resting position.

### Chart View

#### General Assessment

Weight	261 lb
Height	5 ft, 10 in
Blood pressure (BP)	163/91 mm Hg
Pulse	82 beats/min
Respiratory rate	16 beats/min
Temperature	98.4° F (36.9° C)

#### Laboratory Testing (Fasting)

Cholesterol	239 mg/dL
Triglycerides	150 mg/dL
HDL	28 mg/dL
LDL	181 mg/dL

#### Current Medications

Ramipril (Altace)	10 mg/day
Metoprolol (Lopressor)	25 mg twice a day
Aspirin	81 mg/day
Simvastatin (Zocor)	20 mg/day



## PART 1 MEDICAL-SURGICAL CASES

1. What are the likely sources of his calf pain and his hip pain?
  - Given S.P.'s history, his calf pain is caused by intermittent claudication—a reproducible severe pain in the calf muscle that occurs during exercise and is relieved during rest. It should be noted that patients with advanced or severe arterial occlusive disease would experience pain even at rest.
  - The history of his hip pain is consistent with osteoarthritis—the pain does not disappear promptly after exercise, may be associated with changes in the weather, and can vary in intensity.
  - Another possible source of hip pain could be pseudoclaudication—this pain is caused by neurospinal canal compression. The pain is related to posture and is not made worse with exertion or relieved with rest. Pseudoclaudication causes pain when the body is in an erect position or leaning forward (leaning over a shopping cart); lying or sitting can relieve the pain.
  
2. S.P. has several risk factors for PAD. From his history, list two risk factors, and explain the reason they are risk factors.
  - **Tobacco use:** Smoking is associated with increased serum concentrations of cholesterol. It is also associated with decreased serum HDL. The changes put the individual at increased risk for atherosclerosis and heart disease. In addition, cigarette smoking can cause transient arterial constriction.
  - **Hypertension:** HTN weakens blood vessel walls and increases the risk of intimal thickening. Intimal thickening is associated with atherosclerotic disease.
  - **Hyperlipidemia:** Elevated lipids are associated with atherosclerosis and therefore increased risk of coronary and cerebrovascular events. Controlling lipid levels reduces disease progression and helps alleviate symptoms. A diet high in vegetables, fruits, and whole grains and low in saturated fat, cholesterol, and salt will help to reduce his lipid levels as well as his weight.
  
3. You decide to look at S.P.'s lower extremities. What signs do you expect to find with PAD? Select all that apply.
  - a. Cool or cold extremity
  - b. Thin, shiny, and taut skin
  - c. Brown discoloration of the skin
  - d. Decreased or absent pedal pulses
  - e. Ankle edema
  - f. Thick, brittle nails

**Answers: a, b, d, f**

Assessment findings for PAD include diminished or absent pulses below the level of stenosis; cool or cold extremity; shiny, thin, taut skin that can be fragile; diminished or loss of hair in a stocking pattern; loss of subcutaneous tissue; and nail changes—thick, brittle, slow growing. Brown discoloration of the skin and ankle edema are changes found with venous disease.
  
4. You ask further questions about the clinical manifestations of PAD. Which of these would you expect S.P. to have, given the diagnosis of PAD? Select all that apply.
  - a. Dependent rubor
  - b. Paresthesia
  - c. Constant, dull ache in his calf or thigh
  - d. Rest pain at night
  - e. Pruritus of the lower legs
  - f. Elevation pallor

Answer: a, b, d, f

Dependent rubor, paresthesia, rest pain at night, and elevation pallor are all clinical manifestations of PAD. A constant, dull ache in the calf and pruritus are associated with venous disease.

5. What is the purpose of the daily aspirin listed in S.P.'s current medication?  
Aspirin acts as a platelet aggregation inhibitor and is used to prevent thromboembolism. In S.P.'s case, his history of CABG and CAD place him at higher risk for other cardiovascular events such as myocardial infarction (MI), cerebrovascular accident (CVA), and pulmonary embolism.

#### CASE STUDY PROGRESS

S.P.'s primary care provider has seen him and wants you to schedule him for an ankle-brachial index (ABI) test to determine the presence of arterial blood flow obstruction. You confirm the time and date of the procedure and then call S.P. at home.

6. What will you tell S.P. to do to prepare for the tests?  
Instruct him not to smoke for at least 30 minutes before the test because nicotine creates constriction of the peripheral arteries and alters the test results. In addition, instruct him to wear clothes that are easy to remove or pull up or down because BP cuffs will be placed on both arms and legs. He will need to lie still during the test. Inform him that the test is painless and takes about 30 minutes and that he can eat before the test.

#### CASE STUDY PROGRESS

S.P.'s ABI results showed 0.43 right (R) leg and 0.59 left (L) leg. His primary care provider discusses these results with him and decides to wait 2 months to see whether his symptoms improve with medication changes and risk factor modification before deciding about surgical intervention. S.P. receives a prescription for clopidogrel (Plavix) 75 mg daily and is told to discontinue the daily aspirin. In addition, S.P. receives a consultation for physical therapy.

7. What do these ABI results indicate?  
The ABI is a ratio that is derived by dividing the ankle BP by the brachial BP. An ABI of less than 0.9 in either leg is diagnostic of PAD. S.P.'s right leg shows a lower ABI, which means the disease is worse in his right leg. His results indicate moderate PAD.
8. You counsel S.P. on risk factor modification. What would you address, and why?  
*Quit smoking:* Smoking cessation reduces the progression of the disease. Among other things, smoking can cause repetitive endothelial damage that leads to increased risk of atherosclerosis and related damage.  
*Exercise:* Exercise decreases vascular resistance and enhances blood flow to the exercised extremity. It is important to encourage the patient to walk through some of the pain before resting; this stimulates the growth of new blood vessels to supply the oxygen- and nutrient-deprived muscles. Claudication symptoms will decrease as collateral circulation is formed.  
*Control BP:* Patients who have PAD almost certainly have concomitant cardiovascular and cerebrovascular disease. Reducing BP helps reduce the risk of morbidity from all vascular problems.  
*Comply with medication regimen:* Patients need to be educated about the importance of taking their medication as prescribed. It might be helpful to explain how each medication will help with the treatment of PAD. For example, lipid-lowering agents, antihypertensives, and antiplatelet agents, such as aspirin or clopidogrel, all help decrease the patient's risk for cardiovascular and cerebrovascular disease.

## PART 1 MEDICAL-SURGICAL CASES

## 9. How will the physical therapy help?

Exercise may improve collateral circulation to the limb. Exercise will be started slowly and gradually increased. S.P. will be instructed to walk to the point of claudication, stop, rest, then to walk a little farther. As collateral circulation improves, the distances walked will improve. It will take persistence on S.P.'s part to continue this exercise.

## 10. In addition to risk factor modification, what other measures to improve tissue perfusion or to prevent skin damage should you recommend to S.P.?

- Ensure adequate hydration to prevent increased blood viscosity.
- Avoid exposing the right leg to temperatures below 70° F (21.1° C) to prevent vasoconstriction and subsequent reduction of arterial blood flow.
- Do not use heating pads and hot water bottles—the skin has poor circulation and is subject to injury.
- Avoid crossing the legs, especially at the knee; it will further impair circulation.
- Take steps to prevent trauma to tissue; for example, wear socks or protective footwear at all times (do not go barefoot).
- Use minimal pressure when applying lotions or creams because excessive pressure can damage the skin. Tissue oxygenation is already compromised because of impaired arterial circulation. Any damage to this tissue can result in ulceration.

## 11. S.P. tells you his neighbor told him to keep his legs elevated higher than his heart and asks for compression stockings to keep swelling down in his legs. How should you respond?

- Elevating the legs and using compression stockings are common treatments for venous problems in the lower extremities. S.P. does not have those problems; he has arterial problems, and wearing compression stockings or socks with tight banding could further impair his circulation.
- His legs should be kept in a slightly dependent position to allow gravity to help with circulation.



## 12. S.P. has been on aspirin therapy but now will be taking clopidogrel instead. What is the most important aspect of patient teaching that you will emphasize with this drug?

The risk for bleeding! He should be taught to report any unusual bleeding from anywhere in the body, such as nosebleeds and dark, tarry stools. If bleeding occurs from a cut, he will need to apply direct pressure to the site for 3 to 5 minutes or longer. He should wear a medical alert bracelet or necklace, or carry an identification card that specifies that he is on this medication. He needs to notify his dentist or other health care providers that he is on this medication before a procedure is scheduled.

**CASE STUDY OUTCOME**

S.P. asks for nicotine patches to assist with smoking cessation and makes an appointment for a physical therapy evaluation and a nutritional assessment. He assures you he does not want to lose his leg and will be more careful in the future.



## Case Study 7 Atrial Fibrillation and Oral Anticoagulation

**Difficulty:** Beginning

**Setting:** Outpatient anticoagulation clinic

**Index Words:** atrial fibrillation, bleeding complications, drug interaction, warfarin, patient education, PT/INR monitoring, vitamin K, enoxaparin, safety precautions

**Giddens Concepts:** Caregiving, Clotting, Patient Education, Perfusion

**HESI Concepts:** Assessment, Caregiving, Clotting, Patient Education, Perfusion

### ► Scenario

You are the nurse working in an anticoagulation clinic. One of your patients is K.N., who has a long-standing history of an irregular heartbeat, known as *atrial fibrillation* or *A-fib*, for which he takes the oral anticoagulant warfarin (Coumadin). Recently K.N. had his mitral heart valve replaced with a mechanical valve.

1. How does atrial fibrillation differ from a normal heart rhythm?

When the heart is beating with a normal rhythm, the atria contract together, pumping blood into the ventricles, then the ventricles contract, pumping blood into the pulmonary arteries and aorta. With atrial fibrillation, the atria beat in a disorganized manner, at a rate of 350 to 600 times per minute—as if they are “quivering.” The result is no atrial contractions with an irregular ventricular response; in fact, the ventricles often beat with a rapid rate in response to the increased number of atrial impulses. The rapid yet irregular ventricular rate decreases ventricular filling and reduces cardiac output.

2. What is the purpose of the warfarin (Coumadin) in K.N.'s case?

The purpose of the warfarin is twofold. It is given to prevent thrombus formation. K.N. has a mechanical heart valve, which puts him at a higher risk for thrombus formation. In addition, during atrial fibrillation, blood pooling in the quivering atria might also lead to thrombus formation, which might lead to embolic events, such as pulmonary embolus or cerebrovascular accident (CVA).

### CASE STUDY PROGRESS

K.N. calls your anticoagulation clinic to report a nosebleed that is hard to stop. You ask him to come into the office to check his coagulation levels. The laboratory technician draws a PT/INR test.

3. What is a PT/INR test, and what are the expected levels for K.N.? What is the purpose of the INR?

PT stands for *prothrombin time* and is used to monitor the adequacy of warfarin therapy. However, PT results can vary from facility to facility because of different reagents or methods used. INR stands for *international normalized ratio*, a mathematical calculation. INR results are independent of the reagents or methods used, thus providing more standardized monitoring. INR goals vary according to the indication. For deep vein thrombosis prophylaxis, the preferred INR levels would be 1.5 to 2.0. For atrial fibrillation, the preferred INR is 2.0 to 3.0. However, because K.N. also has a mechanical valve, the preferred INR would be as high as 2.5 to 3.5.

## PART 1 MEDICAL-SURGICAL CASES

4. When you get the results, his international normalized ratio (INR) is critical at 7.2. What is the danger of this INR level?

*This INR level exceeds the INR goals for K.N. At this high level, his blood's clotting ability is severely impaired, and he is at an increased risk for bleeding. His health care provider will want to examine him to determine whether he has other complications associated with excessive anticoagulation. In lay terms, his blood is "too thin."*

**CASE STUDY PROGRESS**

The health care provider does a brief focused history and physical examination, orders additional laboratory tests, and determines that there are no signs of bleeding other than the nosebleed, which has stopped. The provider discovers that K.N. recently started to take daily doses of an over-the-counter proton pump inhibitor (PPI), omeprazole (Prilosec OTC), for heartburn.

5. What happened when K.N. began taking the PPI?  
*A drug interaction occurred. The PPI prolonged the effects of the warfarin. As a result, K.N. had an increased risk of bleeding.*
6. What should K.N. have done to prevent this problem?  
*He should have called the anticoagulant clinic before starting the PPI to check whether there could be a drug interaction.*
7. The provider gives K.N. a low dose of vitamin K orally, asks him to hold his warfarin dose that evening, and asks him to come back tomorrow for another prothrombin time (PT) and INR blood draw. Why is K.N. instructed to take the vitamin K?  
*The goal of vitamin K therapy is to reverse the excessive anticoagulation of his blood to bring his INR down to the goal levels.*
8. You want to make certain K.N. knows what "hold the next dose" means. What should you tell him?  
*"Hold the next dose" means he should skip, or not take, warfarin that evening.*
9. K.N. asks you why his PT/INR has to be checked so soon. How will you respond?  
*"We need to be certain that the vitamin K has been effective in lowering your PT/INR to a safe range. Also, we need to ensure you do not have any complications from the high INR."*

**CASE STUDY PROGRESS**

K.N.'s INR the next day is 3.7, and the health care provider makes no further medication changes. K.N. is instructed to return again in 7 days to have another PT/INR drawn.

10. Why should the INR be checked again so soon instead of the usual monthly follow-up?  
*To be certain his INR level has stabilized (within the desired range) and to monitor for any complications. Because the coagulation effect of vitamin K lasts for 1 week, he will not respond normally to warfarin for approximately 1 week after taking vitamin K.*

11. K.N. grumbles about all of the laboratory tests but agrees to follow through. You provide patient education to K.N. and start with reviewing the signs and symptoms (S/S) of bleeding. What are potential S/S of bleeding that should be taught to K.N.? (Select all that apply.)
- Black, tarry stool
  - Stool that is pale in color
  - New onset of dizziness
  - Insomnia
  - New joint pain or swelling
  - Unexplained abdominal pain

Answers: a, c, e, f

S/S of bleeding include:

- Pink, brown, or red-tinged urine
  - Blood in the stool; black, tarry stool; blood in the toilet water
  - Coughing or spitting blood
  - Nosebleeds or unexplained bleeding of any kind
  - New dizziness, lightheadedness, unexplained abdominal pain
  - New joint pain or swelling
  - Cuts that won't stop bleeding
  - Unexplained bruising and excessive bruising
  - Prolonged menstrual bleeding for premenopausal women
12. Identify two other patient education needs that you need to stress at this time.
- Remind him that many things interact with warfarin, and he needs to keep his provider informed of any new medications. Patients are usually given a handout listing the major things that affect INR. Ask whether he needs another copy of the warfarin education packet that he was given when warfarin therapy was started.
  - Remind him that not all providers know what interacts with warfarin. He needs to inquire about warfarin interaction whenever any changes are being made.
  - He needs to consider wearing a medical alert necklace or bracelet that would let others know that he is on anticoagulant therapy with warfarin.
13. Four months later, K.N. informs you that he is going to have a knee replacement next month. What will you do with this information?
- Alert his health care provider about the pending surgery.

### CASE STUDY PROGRESS

You know that sometimes the only needed action is to stop the warfarin (Coumadin) several days before the surgery. Other times, the provider initiates "bridging therapy," or stops the warfarin and provides anti-coagulation protection by initiating low-molecular-weight heparin. After reviewing all of his anticoagulation information, the provider decides that K.N. will need to stop the warfarin (Coumadin) 1 week before the surgery and in its place be started on enoxaparin (Lovenox) therapy.

## PART 1 MEDICAL-SURGICAL CASES

14. Compare the duration of action of warfarin (Coumadin) and enoxaparin (Lovenox) and explain the reason the provider switched to enoxaparin at this time.

Warfarin has a duration of 2 to 5 days; enoxaparin has a duration of 12 hours. K.N. is still at risk for thrombus formation because of the atrial fibrillation. Yet he needs to have the knee surgery, and it would be risky to perform the knee surgery while K.N. is anticoagulated with warfarin—there would be a risk of excessive bleeding during and after the surgery. Therefore, the warfarin is discontinued in advance of the surgery because it will take several days for the anticoagulation effects to wear off. However, the enoxaparin can still be given at this time to provide needed levels of anticoagulation. It will be stopped just before the surgery because of its shorter duration. The goal is to have him off oral anticoagulation for a minimum amount of time to prevent the possible risk of a clot formation and potential stroke. His provider will monitor him closely before and after surgery.

## CASE STUDY PROGRESS

K.N. is in the office and ready for his first enoxaparin (Lovenox) injection.

15. Which nursing interventions are appropriate when administering enoxaparin? Select all that apply.
- Monitor activated partial thromboplastin time (aPTT) levels.
  - Administer via intramuscular (IM) injection into the deltoid muscle.
  - The preferred site of injection is the lateral abdominal fatty tissue.
  - Massage the area after the injection has been given.
  - Hold extra pressure over the site after the injection.

Answers: c, e

It is not necessary to monitor aPTT levels for enoxaparin therapy. This drug is given by deep subcutaneous injection into the fatty tissue between the left and right anterolateral and left and right posterolateral abdominal wall. The area should not be massaged after the injection because excessive bruising might occur. Holding extra pressure over the injection site might be needed to prevent excessive bleeding; K.N. has been on an anticoagulant up to this time.

## CASE STUDY PROGRESS

K.N. undergoes knee surgery without complications. Just before his discharge, his physician reviews the instructions and gives him a new prescription for warfarin (Coumadin). K.N. tells his doctor, "I saw this commercial for a new blood thinner called Xarelto. I'd like to take that instead because I wouldn't need to have all this blood work done."

16. How do you expect the physician to respond?

Xarelto (generic name rivaroxaban) is a factor Xa inhibitor that may be used for anticoagulation in patients with atrial fibrillation. However, K.N. has an artificial heart valve, and rivaroxaban is not indicated in patients with atrial fibrillation in the presence of heart valve problems.

## CASE STUDY OUTCOME

K.N. is discharged to a rehabilitation facility where he makes a quick recovery from the knee replacement surgery. He does not experience any thrombotic events or bleeding episodes during his recovery.





## Case Study 8 Venous Thromboembolism

**Difficulty:** Intermediate

**Setting:** Hospital

**Index Words:** deep vein thrombosis (DVT), atrial fibrillation, atrial flutter, laboratory values, medications, assessment, diagnostic tests, documentation, patient education, electrocardiogram (ECG) strip, pain, dosage calculation

**Giddens Concepts:** Care Coordination, Clotting, Pain, Patient Education, Perfusion

**HESI Concepts:** Assessment, Care Coordination, Clotting, Pain, Patient Education, Perfusion

### ► Scenario

You are assigned to care for L.J., a 70-year-old retired bus driver who has just been admitted to your medical floor with right leg deep vein thrombosis (DVT). L.J. has a 48-pack-year smoking history, although he states he quit 2 years ago. He has had pneumonia several times and frequent episodes of atrial flutter or fibrillation. He has had two previous episodes of DVT and was diagnosed with rheumatoid arthritis 3 years ago. Two months ago he began experiencing shortness of breath on exertion and noticed swelling of his right lower leg that became progressively worse until it extended up to his groin. His wife brought him to the hospital when he complained of increasingly severe pain in his leg. When a Doppler study indicated a probable thrombus of the external iliac vein extending distally to the lower leg, he was admitted for bed rest and to initiate heparin therapy. His basic metabolic panel was normal; other laboratory results were as follows.

### Chart View

#### Laboratory Testing

PT	12.4 sec
INR	1.11
aPTT	25 sec
Hgb	13.3 g/dL
Hct	38.9%
Cholesterol	206 mg/dL

#### 1. List six risk factors for DVT.

Most risk factors fall within the three categories of Virchow triad:

- **Venous stasis:** lengthy surgery, immobility, older than age 40, pregnancy, atrial fibrillation, heart failure, obesity, stroke, denervated limb, hip or knee replacement
- **Venous endothelial injury:** previous DVT, IV catheter, fractures, chemical injury (e.g., cigarette or tobacco products, elevated glucose), trauma, varicose veins, hypertension
- **Hypercoagulability:** malignant neoplasms, dehydration, oral contraceptives, estrogen therapy, sepsis, blood dyscrasias, burns, genetic predisposition (i.e., antiphospholipid syndrome, activated protein C resistance, protein C deficiency, protein S deficiency, antithrombin III deficiency, and factor V Leiden)

## PART 1 MEDICAL-SURGICAL CASES

2. Identify at least five problems from L.J.'s history that represent his personal risk factors.
  - Smoking history
  - Decrease in mobility related to shortness of breath and rheumatoid arthritis
  - History of atrial flutter or fibrillation
  - Previous DVT
  - 70 years of age
  - Lifetime history of sedentary jobs
3. Something is missing from the scenario. Based on his history, L.J. should have been taking an important medication. What is it, and why should he be taking it?

An oral anticoagulant, such as warfarin (Coumadin) or rivaroxaban (Xarelto), would be given because of his history of multiple DVT and atrial flutter and fibrillation.
4. Keeping in mind L.J.'s health history and admitting diagnosis, what are the most important assessments you will make during your physical examination and assessment?

*Cardiovascular:* Obtain baseline vital signs (VS); assess heart sounds; compare perfusion of the extremities.

*Venous compromise of affected leg:* Assess warmth, redness, pain, edema, Homans sign, distal pulses, capillary refill, and baseline calf and thigh girth. Don't forget to compare both legs.

*Lungs:* Assess breath sounds; assess for dyspnea and chest pain.

*Mental status:* Assess for confusion, restlessness, and lethargy.
5. What is the most serious complication of DVT?

Pulmonary embolism
6. List at least eight assessment findings you should monitor closely for in the development of the complication identified in Question 5.
  - Crackles
  - Cough
  - Tachycardia
  - Restlessness
  - Dyspnea and tachypnea (occur in 85% of cases)
  - Sudden pleuritic chest pain (occurs in 74% of cases)
  - Apprehension
  - Hemoptysis
  - Fever
  - Nausea and vomiting
  - Cyanosis
7. You review the literature for DVT and see the abbreviation *VTE*. What does VTE mean?

*VTE* is the abbreviation for *venous thromboembolism* and is the general term used to describe the disease process venous thromboembolism, which includes DVT and pulmonary embolus (PE).

**CASE STUDY PROGRESS**

Your assessment of L.J. reveals bibasilar crackles with moist cough; normal heart sounds; blood pressure (BP) 138/88 mm Hg; pulse 104 beats/min; 3+ pitting edema of right lower extremity; mild erythema of right foot and calf; and severe right calf pain. He is awake, alert, and oriented but a little restless. His Spo<sub>2</sub> is 92% on room air. He denies chest pain but does have shortness of breath with exertion. He states he is anxious about missing his grandson's wedding. He denies any voiding problems.

8. Your institution uses electronic charting. Based on the assessment noted previously which of the following systems would you mark as “abnormal” as you document your findings? For abnormal findings provide a brief narrative note.

- Abnormal  
 Neurologic:  
 Respiratory:  
 Cardiovascular:  
 Genitourinary:  
 Skin:  
 Psychosocial:  
 Pain:

**X Neurologic:** Awake, alert, and oriented, but restless.

**X Respiratory:** Bibasilar crackles with moist cough. Spo<sub>2</sub> 92% on room air. States he is short of breath on exertion.

**X Cardiovascular:** BP 138/88 mm Hg; pulse 104 beats/min.

Genitourinary:

**X Skin:** 3+ pitting edema of right lower extremity; mild erythema of right foot and calf.

**X Psychosocial:** States he is “anxious” about missing his grandson's wedding.

**X Pain:** Complains of severe right calf pain.

**CASE STUDY PROGRESS**

L.J. is placed on 72-hour bed rest with bathroom privileges and given acetaminophen (Tylenol) for pain. The physician writes orders for enoxaparin (Lovenox) injections.

9. L.J. asks, “Why do I have to get these shots? Why can't I just get a Coumadin pill to thin my blood?” What would be your response?”
- “Good idea! I will call to ask the physician to switch medications.”
  - “It would take the Coumadin pills several days to be effective.”
  - “Your physician prefers the injections over the pills.”
  - “The enoxaparin will work to dissolve the blood clot in your leg.”

**Answer: b**

**Enoxaparin takes 3 to 5 hours to reach maximum antithrombotic activity; warfarin (Coumadin) takes 12 to 24 hours for onset and peaks in 1½ to 4 days. It takes several days for warfarin to reach effective anticoagulation level.**

## PART 1 MEDICAL-SURGICAL CASES

10. The order for the enoxaparin reads: Enoxaparin 70 mg every 12 hours subcut. L.J. is 5 ft, 6 in tall and weighs 156 lb. Is this dose appropriate?

The appropriate dose for enoxaparin is 1 mg/kg.  $154 \text{ lb} = 70 \text{ kg}$ .

$1 \text{ mg/kg} \times 70 \text{ kg} = 70 \text{ mg}$ ; therefore the ordered dose of 70 mg is appropriate for L.J.

11. What special techniques do you use when giving the subcutaneous injection of enoxaparin? Select all that apply.

- Rotate injection sites.
- Give the injection near the umbilicus.
- Expel the bubble from the prefilled syringe before giving the injection.
- After inserting the needle, do not aspirate before giving the injection.
- Massage the injection site gently after the injection is given.

Answers: a, d

The injection sites are the left or right anterolateral or left or right posterolateral abdominal wall; the injection should be at least 2 inches away from the umbilicus because of the vascular structure near the umbilicus. Injection sites need to be rotated to reduce bruising. Do not expel the bubble from the prefilled syringes. Do not aspirate before giving the injection; this might cause more trauma to the injection site and increase bruising. You might need to hold gentle pressure on the injection site to reduce bleeding, but do not massage the site because this will also increase bruising.

12. True or False: Enoxaparin dosage is directed by monitoring aPTT levels. Explain your answer.

False. Low-molecular-weight heparins, such as enoxaparin, do not require any laboratory monitoring because of their greater affinity for factor Xa (compared with heparin, which is monitored by aPTT levels when given intravenously).

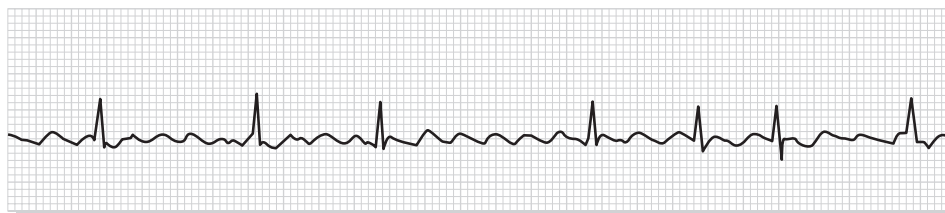
13. What instructions will you give L.J. about his activity?

- Maintain bed rest to prevent dislodgment of an embolus from the DVT. Ask him to immediately report to you any signs or symptoms of pulmonary embolism.
- Frequently change positions in bed; this helps prevent problems of immobility.
- Perform frequent gentle dorsiflexion and plantar flexion of the feet, and perform ankle circles to promote circulation and to facilitate venous return.
- Do not cross legs; crossing legs can decrease circulation.
- Do not massage right leg; massage could dislodge a thrombus.
- Keep right leg elevated without pressure under the knee to promote circulation.
- Avoid sudden muscle movement of affected limb, which could dislodge a thrombus.

14. What pertinent laboratory values and measurements would you expect the physician to order and the results of which you will monitor? Explain the reason for each test.

- Platelet count: Enoxaparin might decrease the platelet count.
- Complete blood count (CBC): Used to monitor for blood loss from bleeding that might or might not be evident while L.J. is on anticoagulant therapy.
- Chest x-ray (CXR) examination: For evaluation of pulmonary and cardiac systems.
- D-dimer assay: High levels are associated with thrombotic problems, such as DVT.
- V/Q scan (ventilation/perfusion lung scan): Used to test for the presence of pulmonary embolism.
- Computerized tomographic angiography (CT angiography or CTA): Used to test for the presence of pulmonary embolism.
- Arterial blood gases (ABGs): Used to monitor respiratory status and oxygenation.
- Test for occult blood in stool (guaiac) and/or emesis: To monitor for occult gastrointestinal bleeding.

15. You identify pain as a key issue in the care of L.J. List four interventions you will choose for L.J. to address his pain.
- Get specific information on the symptoms; verify with the patient the location, quality, intensity, onset, duration, and expression of pain.
  - Assess and monitor those factors that increase or decrease pain.
  - Assess and monitor emotional responses and coping mechanisms to pain.
  - Eliminate or modify those stimuli that increase pain.
  - Evaluate the effectiveness of his pain medication.
  - Teach him techniques he can use to modify his own pain (e.g., relaxation, imagery, distraction).
16. You evaluate L.J.'s electrocardiogram (ECG) strip. Name this rhythm, and explain what consequences it could have for L.J.



The rhythm is atrial flutter. You can see flutter waves with varying numbers between the QRS intervals. The problem with atrial flutter is that the atria are “quivering,” or not contracting correctly. Blood can pool inside the atria, and clot formation might occur.

#### CASE STUDY PROGRESS

A week has passed. L.J. responded to heparin therapy and was bridged to oral warfarin therapy. His heart dysrhythmia converted to sinus rhythm after he started taking cardiac medications, and he is being discharged to home with home care follow-up. “Good,” he says, “just in time to fly out west for my grandson's wedding. His wife, who has come to pick him up, rolls her eyes and looks at the ceiling.

17. Although you are surprised at his comment, you realize he is serious about going to the wedding. What are you going to tell him?
- You observe that L.J. doesn't seem to have realistic expectations associated with his recovery, so you explain the following:
- He is going to require daily follow-up visits to monitor his status.
  - Sitting on a plane for several hours, along with the vigorous activity required to make plane changes, is not safe for him at this time. He is likely to have another DVT develop from sitting on the plane (not to mention sitting at the wedding and reception). He is going to continue to receive warfarin for life and will be at risk for bleeding and bruising; in addition, after his hospitalization and bed rest, it will take him weeks or even months to adapt to the rigors of everyday life.
  - Explore with him the possibility of sending an audiotaped or videotaped message from him to the newlyweds. Ask whether anyone can video-record the ceremony and parts of the reception for him to view at home so that he won't feel so isolated.

#### CASE STUDY OUTCOME

L.J. listens to you, and his wife is quite relieved. L.J.'s son arranges to record the wedding ceremony, and guests at the reception record special greetings for him. It's been 2 weeks, and he seems quite pleased. He watches the recording daily and points out his favorite parts to the home care nurse every time she visits.





## Case Study 9 Abdominal Aortic Aneurysm

**Difficulty:** Intermediate

**Setting:** Hospital, home care

**Index Words:** abdominal aortic aneurysm (AAA), hypertension (HTN), patient education, surgery, assessment

**Giddens Concepts:** Care Coordination, Patient Education, Perfusion

**HESI Concepts:** Assessment, Care Coordination, Patient Education, Perfusion

### ► Scenario

A.H. is a 70-year-old retired construction worker who has experienced lumbosacral pain, nausea, and upset stomach for the past 6 months. He has a history of heart failure, high cholesterol, hypertension (HTN), sleep apnea, and depression. His chronic medical problems have been managed over the years with oral medications: benazepril (Lotensin) 5 mg/day, fluoxetine (Prozac) 40 mg/day, furosemide (Lasix) 20 mg/day, Potassium chloride (KCl) 20 mEq bid, and lovastatin (Mevacor) 40 mg with the evening meal.

A.H. has just been admitted to the hospital for surgical repair of a 6.2-cm abdominal aortic aneurysm (AAA) that is now causing him constant pain. On arrival on your floor, his vital signs (VS) are 109/81, 61, 16, and 98.3° F (36.8° C). When you perform your assessment, you find that his apical heart rhythm is regular and his peripheral pulses are strong. His lungs are clear, and he is awake, alert, and oriented. There are no abnormal physical findings; however, he hasn't had a bowel movement for 3 days. His electrolytes, blood chemistries, and clotting studies are within normal range, except his hematocrit is 30.1%, and hemoglobin is 9 g/dL.

1. A.H. has several common risk factors for AAA that are evident from his health history. Identify and explain three factors.

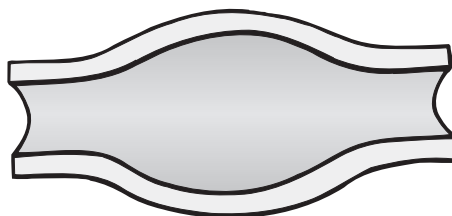
*Hyperlipidemia, leading to atherosclerosis: This is inferred because he is taking lovastatin, a drug used to reduce serum lipid levels. Atherosclerosis injures vessel walls, causing weakness.*

*HTN: The elevated blood pressure (BP) puts a continuous strain on weakened arterial walls.*

*Advanced age: HTN and atherosclerosis are more common in the elderly.*

*Male gender: For unknown reasons, the incidence of AAA is higher in men.*

2. Angiography reveals an aneurysm with a shape as in the accompanying illustration. What type of aneurysm is this?



- a. Saccular aortic aneurysm
- b. Fusiform aortic aneurysm
- c. Aortic dissection
- d. False aortic aneurysm

**Answer: b**

*This is an illustration of a fusiform aortic aneurysm. This type of aneurysm is circumferential and has a relatively uniform shape.*

## PART 1 MEDICAL-SURGICAL CASES

## CASE STUDY PROGRESS

While A.H. awaits his surgery, it is important that you monitor him carefully for decreased tissue perfusion.

3. Identify five things you would assess for, and state your rationale for each.
  - Urinary output:* A decrease in kidney perfusion will result in decreased urine production.
  - Abdominal or lumbosacral pain:* An increase in pain can mean enlargement of the aneurysm or possible leakage.
  - Bowel sounds:* Decreased or absent bowel sounds can indicate decreased perfusion of the gastrointestinal (GI) tract.
  - Peripheral circulation:* Decrease in pedal pulses, coolness, cyanosis, or mottling of the skin of the feet, or increase in capillary refill time, indicates impaired peripheral circulation.
  - Chest pain:* If perfusion of the myocardium is decreased, the heart can become ischemic.
  - VS:* Hypotension, tachycardia, and tachypnea are signs of hypovolemia or hemorrhagic shock.
  - Level of consciousness (LOC):* If cerebral perfusion is diminished, the patient might become confused and anxious.
4. What is the most serious, life-threatening complication of AAA and why?
  - Rupture of the aneurysm:* A ruptured aneurysm (as opposed to one with a slow leak) is usually rapidly fatal.
5. What single problem mentioned at the beginning of this case study presents a risk for AAA rupture? Why?
  - Risk for AAA rupture is evident in the statement, "He hasn't had a bowel movement for 3 days." Straining to have a bowel movement (Valsalva maneuver) can cause a profound increase in intra-abdominal pressure that could result in rupture.*
6. During your assessment you notice a pulsation in A.H.'s upper abdomen, slightly left of the midline, between the umbilicus and the xiphoid process. True or False: You will need to palpate this mass as part of your physical assessment. Explain your answer.
  - False. If a pulsating abdominal mass is noted, you might gently auscultate it for a bruit, but do not palpate the mass! It might be tender, but more important, there is a risk of rupture of the aneurysm with palpation.*

## CASE STUDY PROGRESS

The resection of A.H.'s aneurysm is successful, but for the first 3 postoperative days he is delirious and requires one-to-one nursing care before he becomes coherent and oriented again. He is transferred back to your floor.

7. What assessments should be made that are specific to his postoperative care?
  - Check pulses distal to the aneurysm to make certain the graft has not clotted off. In addition, check the temperature of the extremities below the graft.
  - Maintain his BP within the range specified by the surgeon to (1) allow the clot to form on the inside of the graft and (2) ensure that the graft does not separate as a result of high BP.
  - Continuous cardiac monitoring will be done to watch for any dysrhythmias.
  - Monitor intake and output every 8 hours; blood urea nitrogen (BUN) and creatinine levels, and daily weights to observe for any fluid retention and monitor renal function.
  - Monitor for other signs of graft occlusion, such as severe pain, abdominal distention, and white or blue extremities or flank.



8. List five problems that are high priorities in A.H.'s postoperative care.
- Pain from his surgery.
  - Confusion or disorientation related to the surgical intervention.
  - Risk for infection as a result of the surgery.
  - Possible altered systemic tissue perfusion as the result of a leak, rupture, or occlusion of the aortic graft.
  - Possible hypoventilation (breathing too shallowly) because of pain and history of sleep apnea and abdominal surgery.
  - Possible constipation because of his history of constipation, pain medication use, and the abdominal surgery (inability to bear down effectively to create sufficient intra-abdominal pressure).
  - VTE (venous thromboembolism) prophylaxis. Typically, a parenteral anticoagulant such as a low-molecular-weight heparin is ordered subcutaneously, and/or mechanical prophylaxis such as intermittent pneumatic compression devices (ICPDs) are implemented after surgery.
  - Reduced physical mobility as a result of his surgery.
9. During the postoperative period after an aneurysmectomy, the nurse will implement which actions? Select all that apply.
- a. Keep the head of the bed (HOB) elevated at 60 degrees.
  - b. Keep firm pressure on the abdominal incision during coughing exercises.
  - c. Change dressings as ordered with aseptic technique.
  - d. Monitor peripheral pulses of both lower extremities.
  - e. Use the bed's knee gatch to allow for knee flexion during bed rest.

Answers: b, c, d

Elevation of HOB should not exceed 30 to 40 degrees because sharp hip flexion could cause the graft to kink. Knees should not be bent because knee flexion compresses popliteal vessels, restricting venous return. Dressing changes should be done with careful aseptic technique. Careful and regular assessment for decreased tissue perfusion (see previous text) should be done to detect leak, rupture, or occlusion of the graft.

### CASE STUDY PROGRESS

When A.H. is being prepared for discharge, you talk to him about health promotion and lifestyle change issues that are pertinent to his health problems.

10. Identify four health-related issues you might appropriately address with him and what you would teach in each area.
- HTN:* Importance of low-sodium diet, proper use of antihypertensive medications, and exercise. With his history of AAA, he will need to keep his BP under control.
- Exercise:* Rationale and methods. Exercise is valuable in the treatment of atherosclerosis and depression, but it is essential that A.H. receive prescriptive exercise guidelines. Exercise carries great benefit, but it also carries great risk if it is done inappropriately.
- Diet and nutritional status:* Importance of low-sodium, low-cholesterol, high-fiber diet. Does he have adequate nutritional intake to promote healing? Obtain a referral to a registered dietitian (RD). He might also benefit from an at-home meal service, such as Meals-on-Wheels, not only for the improved nutrition, but also for the social stimulation.
- Constipation:* Importance of high-fluid, high-fiber intake and exercise.
- Psychosocial support needs:* Discuss resources available in A.H.'s community for meeting psychosocial support needs.

**PART 1 MEDICAL-SURGICAL CASES**

11. A.H. will be receiving follow-up visits from the home health care nurse to change his dressing and evaluate his incision. What can you discuss with A.H. before discharge that will help him understand what the nurse will be doing?
- Explain to A.H. that he will be having a home health care nurse visit him after he goes home. The nurse will take care of his wound and dressing.
  - Ask him whether he would like to look at his incision. This will give you an opportunity to teach him about signs and symptoms of infection or dehiscence. Get a mirror so that he can get a good look while you point out (with a sterile, gloved hand) the incision line and the normal healing tissue color. Tell A.H. to keep an eye on the wound to make sure it is not puffy and that there is nothing oozing from the incision. Let him know that he needs to notify his physician immediately if he notices any sudden drainage, elevated temperature, or sudden severe abdominal pain.
12. Which statement by A.H. indicates a need for further education?
- a. "I will report any fever greater than 100° F"
  - b. "I will avoid heavy lifting for 3 more weeks."
  - c. "I will call my doctor right away if I notice redness or swelling at the incision."
  - d. "I will look for color changes in my feet and lower legs."

**Answer: b**

He should avoid heavy lifting for a period of 6 weeks after surgery to maintain integrity of the surgical graft.



## Case Study 10 Hyperlipidemia

**Difficulty:** Advanced

**Setting:** Outpatient office, cardiac rehabilitation, or lipid clinic

**Index Words:** lifestyle modification, high-density lipoprotein (HDL), low-density lipoprotein (LDL), triglycerides, cholesterol, medications, advanced lipid profiles

**Giddens Concepts:** Care Coordination, Health Promotion, Patient Education

**HESI Concepts:** Assessment, Care Coordination, Health Promotion, Patient Education

### ► Scenario

You are working at the local cardiac rehabilitation center and R.M. is walking around the track. He summons you and asks if you could help him understand his recent laboratory report. He admits to being confused by the overwhelming data on the test and does not understand how the results relate to his recent heart attack and need for a stent. You take a moment to locate his laboratory reports and review his history. The findings are as follows.

R.M. is an active 61-year-old man who works full time for the postal service. He walks 3 miles every other day and admits he doesn't eat a "perfect diet." He enjoys two or three beers every night, uses stick margarine, eats red meat two or three times per week, and is a self-professed "sweet eater." He has tried to quit smoking and is down to one pack per day. Cardiac history includes a recent inferior myocardial infarction (MI) and a heart catheterization revealing three-vessel disease: in the left anterior descending (LAD) coronary artery, a proximal 60% lesion; in the right coronary artery (RCA), proximal 100% occlusion with thrombus; and a circumflex with 40% to 60% diffuse dilated lesions. A stent was deployed to the RCA and reduced the lesion to 0% residual stenosis. He has had no need for sublingual nitroglycerin (NTG). He was discharged on enteric-coated aspirin 325 mg daily, clopidogrel (Plavix) 75 mg daily, atorvastatin (Lipitor) 10 mg at bedtime, and ramipril (Altace) 10 mg/day. Six weeks after his MI and stent placement, he had a fasting advanced lipid profile with other blood work.

### Chart View

#### Six-Week Postprocedure Laboratory Work (Fasting)

Total cholesterol	188 mg/dL
HDL	34 mg/dL
LDL	98 mg/dL
Triglycerides	176 mg/dL
Homocysteine	18 mmol/dL
High-sensitivity C-reactive protein (hsCRP)	8 mg/dL
FBG	99 mg/dL
TSH	1.04 mU/L

## PART 1 MEDICAL-SURGICAL CASES

1. When you start to discuss R.M.'s laboratory values with him, he is pleased about his results. "My cholesterol level is below 200!—and my 'bad cholesterol' is good! That's good news, right?" What would you say to him?  
 He needs further information! After review of his HDL and triglyceride levels, there is still more work to be done. You might explain, "LDL particles are small, dense particles that transport fat into the walls of the arteries, promoting atherosclerosis. LDL levels, when elevated, are positively correlated to coronary artery disease. That is why LDL is often called the 'bad cholesterol.' HDL, however, has a protective action, when levels are sufficient. Your HDL is too low (should be above 40 mg/dL), which decreases your protection from plaque formation. In addition, your triglyceride level should be below 150 mg/dL. When triglycerides are elevated, then triglycerides are deposited into the fatty tissues. You need to work on reducing your triglyceride level and increasing your HDL levels."
2. R.M.'s physician adds niacin, a vitamin preparation (folic acid, vitamin B<sub>6</sub>, and vitamin B<sub>12</sub> [Foltx]) daily with food, and omega-3 fatty acids to his list of medications. How do these medications affect lipids? R.M. states, "But I already take Lipitor. What do all these medications do?" How do you answer him?
  - Atorvastatin (Lipitor) is a "statin," also known as an HMG-CoA reductase inhibitor, and works to reduce cholesterol synthesis. It is used to reduce elevated cholesterol and triglyceride levels, and thus aids in the prevention of cardiovascular disease.
  - Folic acid, B<sub>6</sub>, and B<sub>12</sub> are B vitamins that will help stabilize arteries and prevent restenosis of lesions that have been angioplastied or stented. In addition, they might help reduce the elevated homocysteine level.
  - Niacin will increase HDL particles and provide more protection to the arteries and also works to reduce cholesterol, LDL, and triglyceride levels.
  - Omega-3 fatty acids will help increase HDL and decrease triglycerides. They are also helpful in preventing sudden cardiac death.
3. Discuss the significance of R.M.'s hsCRP level.  
 The hsCRP level can be an indicator of any type of inflammatory response in the body. Values of less than 1.0 mg/dL indicate low risk for heart disease; values of 1.0 to 3.0 mg/dL indicate moderate risk. Values above 3.0 mg/dL place the patient at high risk for heart disease; elevated levels are seen in patients with low HDL and high triglyceride levels, such as in R.M.'s laboratory results.
4. Discuss the significance of the homocysteine test and R.M.'s results.  
 Homocysteine is an amino acid formed during the metabolism of methionine. There is increasing evidence that seems to indicate that elevated levels of homocysteine are associated with the progression of atherosclerosis, thus increasing the risk of heart disease. Normal levels for males are 5.2 to 12.9 mmol/L; R.M.'s result indicates an elevation.
5. What else in R.M.'s history might be contributing to his elevated homocysteine levels?  
 Smoking is associated with increased levels. Also, patients with a low intake of B vitamins might have higher levels of homocysteine.

6. You are teaching R.M. about the side effects of niacin. Which effects will you include in your teaching? Select all that apply.
- Flushed skin
  - Headache
  - Gastrointestinal (GI) distress
  - Pruritus
  - Dizziness

Answers: a, c, d

Niacin might cause flushing of the skin, pruritus, and GI distress.

7. R.M. tells you that he really does not want to “put up with” the side effects of the niacin. Is there an alternative to niacin?

Taking aspirin or a nonsteroidal anti-inflammatory drug (NSAID) 30 minutes before the niacin dose may help to reduce side effects. There are extended-release forms of niacin that may cause fewer side effects.

8. You review his other medications, including atorvastatin (Lipitor). Which statement by R.M. indicates a need for further teaching about this medication?
- “I will take this drug at night.”
  - “I will try to exercise more each week.”
  - “I like to take my medicines with grapefruit juice.”
  - “I will call the doctor right away if I experience muscle pain.”

Answer: c

HMG-CoA reductase inhibitors, or statins, should not be taken with grapefruit juice. Taking this medication with grapefruit juice might lead to toxic levels of the medication.

### CASE STUDY PROGRESS

You enter R.M.'s room and hear the physician say, “There are many options for changing your LDL and triglyceride levels. You need to continue modifying your diet and exercise to enhance your medication regimen.” The physician asks R.M. whether he has any questions, and the patient responds, “No.”

9. After the physician leaves the room, R.M. tells you he really didn't understand what the physician said. Explain the necessary lifestyle changes to R.M.
- “The medications and vitamins will help change the dangerous type of fat to one that is not as bad, but you have to eat a low-fat diet and exercise to lower your risk factors. In addition, your diet is high in refined carbohydrates, such as products made with white flour; these will cause an increase in triglycerides. A diet high in fiber, omega-3 fatty acids, and complex carbohydrates, such as whole grains, fruits, and vegetables, can help to reduce the risks of coronary artery disease (CAD). If you don't change your lifestyle, you run the risk of your stent blocking off again, and you could have a heart attack. In addition, you should try to stop smoking all together, and there are several options available to help with this.”
10. R.M. tells you that he knows that exercise will help him to lose weight, which is good, but he does not understand how exercise helps his cholesterol levels. How do you answer him?
- You can tell him that exercise helps to increase HDL (the “good” cholesterol) levels and also helps to reduce the risk of clot formation. In addition, exercise may also help the development of collateral circulation in the heart muscle.





## Case Study 11 Hypovolemia

**Difficulty:** Advanced

**Setting:** Hospital emergency department, medical intensive care unit

**Index Words:** hypovolemia, hypertension, idiopathic dilated cardiomyopathy, peptic ulcer disease, assessment, laboratory values, fluid balance, hyperkalemia, electrocardiogram (ECG) strip

**Giddens Concepts:** Care Coordination, Fluid and Electrolyte Balance, Perfusion

**HESI Concepts:** Assessment, Care Coordination, Fluid & Electrolyte, Perfusion

### ► Scenario

The wife of C.W., a 70-year-old man, brought him to the emergency department (ED) at 0430. She told the ED triage nurse that he had had diarrhea for the past 3 days and that last night he had a lot of “dark red” diarrhea. When he became very dizzy, disoriented, and weak this morning, she decided to bring him to the hospital. C.W.'s vital signs (VS) in the ED were 70/– (systolic blood pressure [SBP] 70 mm Hg, diastolic blood pressure [DBP] inaudible), pulse rate 110 beats/min, 22 breaths/min, oral temperature 99.1 ° F (37.3 ° C). A 16-gauge IV catheter was inserted and a lactated Ringer's (LR) infusion was started. The triage nurse obtained the following history from the patient and his wife. C.W. has had idiopathic dilated cardiomyopathy for several years. The onset was insidious, but the cardiomyopathy is now severe, as evidenced by an ejection fraction of 13% found during a recent cardiac catheterization. He experiences frequent problems with heart failure (HF) because of the cardiomyopathy. Two years ago, he had a cardiac arrest that was attributed to hypokalemia. He has a long history of hypertension and arthritis. He had atrial fibrillation in the past but it has been under control recently. Fifteen years ago he had a peptic ulcer.

Endoscopy showed a 25- × 15-mm duodenal ulcer with adherent clot. The ulcer was cauterized and C.W. was admitted to the medical intensive care unit (MICU) for treatment of his volume deficit. You are his admitting nurse. As you are making him comfortable, Mrs. W. gives you a paper sack filled with the bottles of medications he has been taking: enalapril (Vasotec) 5 mg PO bid, warfarin (Coumadin) 5 mg/day PO, digoxin (Lanoxin) 0.125 mg/day PO, potassium chloride 20 mEq PO bid, and diclofenac (Voltaren) 50 mg PO tid. As you connect him to the cardiac monitor, you note he is in sinus tachycardia. Doing a quick assessment, you find a pale man who is sleepy but arousable and slightly disoriented. He states he is still dizzy. His BP is 98/52, pulse is 118, and respiratory rate 26. You hear S<sub>3</sub> and S<sub>4</sub> heart sounds and a grade II/VI systolic murmur. Peripheral pulses are all 2+, and trace pedal edema is present. Lungs are clear. Bowel sounds are present, midepigastriac tenderness is noted, and the liver margin is 4 cm below the costal margin. A Swan-Ganz pulmonary artery catheter and a peripheral arterial line are inserted.

#### 1. What may have precipitated C.W.'s gastrointestinal (GI) bleeding?

**Diclofenac:** C.W. has been taking diclofenac for his arthritis. Overwhelming evidence has linked nonsteroidal anti-inflammatory drugs (NSAIDs) to gastroduodenal ulcers and bleeding. NSAIDs irritate the gastric mucosa and decrease the mucosa's ability to protect the stomach lining from hydrochloric acid. Elderly patients have a higher risk for serious GI events related to NSAID therapy.

**Warfarin:** Warfarin inhibits the extrinsic pathway of the coagulation cascade. Although warfarin did not cause the bleeding, it allowed C.W. to bleed in connection with the NSAID use.

## PART 1 MEDICAL-SURGICAL CASES

- From his history and assessment, identify five signs and symptoms (S/S) of GI bleeding and loss of blood volume.
  - Three-day history of diarrhea
  - Dark red blood visible in the stool
  - Dizziness and disorientation, and pale skin because of inadequate perfusion of the cerebral cortex
  - Weakness because of inadequate O<sub>2</sub> tissue perfusion
  - Severe hypotension, a direct result of volume loss
  - Tachycardia, in compensation for hypotension
  - Increased respiratory rate, in compensation for inadequate tissue perfusion
- What is the most serious potential complication of C.W.'s bleeding?  
Hypovolemic shock that could lead to renal failure or even death
- Calculate C.W.'s mean arterial pressure (MAP) and explain why this measure is important. His BP was 98/52. The formula for MAP is:

$$\text{MAP} = (\text{SBP} + 2\text{DBP}) \div 3$$

$$\text{MAP} = (98 + 52 + 52) \div 3; \text{MAP} = 202 \div 3 = 67.3 \text{ mmHg}$$

A MAP greater than 60 mm Hg is needed to perfuse and sustain vital organs under normal conditions. Vital organs will be underperfused and become ischemic if the MAP falls below 60 for a considerable amount of time.

## CASE STUDY PROGRESS

As soon as you get a chance, you review C.W.'s admission laboratory results.

## Chart View

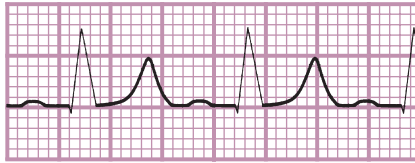
## Laboratory Results

Sodium	138 mEq/L
Potassium	6.9 mEq/L
BUN	90 mg/dL
Creatinine	2.1 mg/dL
WBC	16,000/mm <sup>3</sup>
Hgb	8.4 g/dL
Hct	25%
PT	23.4 seconds
INR	4.8

- After examination of the lab results, are there any concerns with C.W.'s electrolyte levels? Explain your answer.  
C.W.'s potassium level reflects hyperkalemia (above 5 mEq/L), which, in the presence of digoxin, may lead to serious ventricular dysrhythmias. Keep in mind that hyperkalemia may be present in later stages of hypovolemia and that the fluid resuscitation will dilute the potassium.
- In view of the previous laboratory results, what diagnostic test will be performed and why?  
An ECG should be obtained because the patient is on digoxin and has elevated potassium.



7. Evaluate this electrocardiogram (ECG) strip and note the effect of any electrolyte imbalances.



The P waves begin to flatten and become wider as serum potassium increases; the PR interval may be prolonged. The QRS complex begins to widen with potassium levels of 6.0 to 6.5 mEq/L. Also, ST segments disappear. The T waves become narrow, tall, and peaked, sometimes described as “tentlike.” These T waves reach a height that is about 50% of the height of the QRS complex.

8. Why do you think the BUN and creatinine are elevated?

Inadequate renal perfusion as a result of hypovolemia. An elevated BUN may also be secondary to hemolysis related to digestion of blood in the GI tract.

9. What do the low Hgb and Hct levels indicate about the rapidity of C.W.'s blood loss?

Because the Hgb and Hct are low, the bleeding has probably taken place over several days. Interstitial fluid has had time to move into the vascular compartment, diluting the red blood cells (RBCs). In an acute bleed, the Hgb and Hct would be normal (undiluted).

10. What is the explanation for the prolonged PT/INR?

The prolongation is caused by warfarin therapy.

11. What will be your response to the prolonged PT/INR? Select all that apply.

- Prepare to administer a STAT dose of protamine sulfate.
- Hold the warfarin.
- Monitor C.W. for signs and symptoms of bleeding.
- Obtain an order for aspirin if needed for pain.
- Avoid injections as much as possible.

Answers: b, c, e

The warfarin should be held (not only because of the prolonged PT/INR but because of his bleeding), and you should monitor for S/S of further bleeding. Injections need to be avoided as much as possible to reduce bleeding. Vitamin K, not protamine sulfate, is the antidote for management of warfarin toxicity. Aspirin would be contraindicated for C.W. because of its antiplatelet action.



12. What safety precautions should be considered in light of his prolonged PT and INR?

While in the MICU, he should be protected from anything that might cause bruising or bleeding, such as excessive venipuncture and injections. He should use a soft-bristled toothbrush and an electric shaver, not a razor, to avoid the potential for cuts. He should ask for assistance with ambulation, in case he is light-headed during activity, and fall-prevention precautions should be initiated.

13. How do you account for the elevated WBC count?

Physical stress and inflammation caused by the severe bleeding and tissue hypoxia can increase the neutrophil count.

### CASE STUDY PROGRESS

C.W. receives a total of 4 units of packed red blood cells (PRBCs), 5 units of fresh frozen plasma (FFP), and several liters of crystalloids to keep his mean BP above 60 mm Hg. On the second day in the MICU, his total fluid intake is 8.498 L and output is 3.66 L. His hemodynamic parameters after fluid resuscitation are pulmonary capillary wedge pressure (PCWP) 30 mm Hg and cardiac output (CO) 4.5 L/min.

## PART 1 MEDICAL-SURGICAL CASES

14. Calculate his fluid balance and identify whether it is positive or negative.  
His fluid balance is positive, 4.838 L. (Subtract the output, 3.66 L, from the total fluid intake of 8.498 L).
15. Why will you want to monitor his fluid status very carefully?  
C.W. needs fluids and blood products to replace the lost blood volume, but because of his history of HF, it would be easy to overload him with fluids and exacerbate his heart failure, resulting in pulmonary edema.
16. List at least six things you will monitor to assess C.W.'s fluid balance.  
*Urinary output:* Monitor urine output hourly. With inadequate volume to perfuse the kidneys, the urinary output will drop below 30 mL/hr.  
*Fluid intake:* Compare output and intake. Fluid intake includes anything that is liquid at room temperature. Do not forget to include intravenous products.  
*Daily weight:* Fluid weight is lost or gained rapidly and is an excellent indicator of changes in fluid volume.  
*VS:* As the intravascular volume rises in response to IV fluids, the BP can be expected to increase and the heart rate to decrease.  
*CO and PCWP:* Both are good measures of left ventricular function and preload. The PCWP is already high; an increase could be a first indication of fluid overload.  
*Mental status:* This is a good indication of cerebral perfusion and  $\text{Sao}_2$ .  
*Lungs:* Crackles and dyspnea are indicators of pulmonary edema.  
*Heart sounds:* An increase in the baseline murmur and gallops could indicate fluid overload.
17. Explain the purpose of the FFP for C.W.  
The purpose is replacement of intravascular fluid and reversal of the effects of warfarin to prevent further bleeding. FFP also contains plasma proteins and clotting factors. The albumin will pull interstitial fluid into the intravascular compartment. The clotting factors will help to control the bleeding.

## CASE STUDY PROGRESS

Mrs. W. has been with her husband since he arrived at the emergency department and is worried about his condition and his care.

18. List five things you might do to make her more comfortable while her husband is in the MICU.
- Explain to her that a nurse is watching her husband closely and that his heart rhythm is being monitored at all times.
  - Explain the equipment (monitoring devices, tubes, wires, alarms) used for his care. Familiarity with them might make them seem less intimidating.
  - Explain all procedures and treatments before they are performed.
  - Report her husband's condition to her regularly. This demonstrates caring if the report is unsolicited. It also engenders trust.
  - Encourage her to take care of herself while her husband is in the hospital by eating well and getting enough rest.
  - Let her know that if she goes home for brief periods, she can call the MICU at any time to inquire about her husband.
  - Encourage her to seek support from friends, family, or clergy.
  - Let her know it is OK to ask questions. Ask her if she has any questions, and encourage her to write them down for future reference in talking with nurses and physicians.



## Case Study 12 Endocarditis

**Difficulty:** Advanced

**Setting:** Hospital, home care

**Index Words:** infective endocarditis, coronary artery disease (CAD), home care, medications, assessment, laboratory values

**Giddens Concepts:** Care Coordination, Glucose Regulation, Infection, Patient Education, Perfusion

**HESI Concepts:** Assessment, Care Coordination, Glucose Regulation, Infection, Patient Education, Perfusion

### ► Scenario

J.F. is a 50-year-old married homemaker with a genetic autoimmune deficiency; she has had recurrent infective endocarditis. The most recent episodes were a *Staphylococcus aureus* infection of the mitral valve 16 months ago and a *Streptococcus viridans* infection of the aortic valve 1 month ago. During the latter hospitalization, an echocardiogram showed moderate aortic stenosis, moderate aortic insufficiency, chronic valvular vegetations, and moderate left atrial enlargement. Two years ago, J.F. received an 18-month course of total parenteral nutrition (TPN) for malnutrition caused by idiopathic, relentless nausea and vomiting (N/V). She has had coronary artery disease for several years and, 2 years ago had an acute anterior wall myocardial infarction (MI). In addition, she has a history of chronic joint pain.

Now, after having been home for only a week, J.F. has been readmitted to your floor with endocarditis, N/V, and renal failure. Since yesterday, she has been vomiting and retching constantly; she also has had

### Chart View

#### Admission Orders

STAT blood cultures (aerobic and anaerobic) × 2 30 minutes apart  
 STAT CMP & CBC  
 Begin TPN at 85 mL/hr  
 Penicillin G potassium (Pfizerpen) 2 million units IVPB q4h  
 Vancomycin (Vancocin), renal dosing per pharmacy, IVPB q12h  
 Furosemide (Lasix) 80 mg/day PO  
 Amlodipine (Norvasc) 5 mg/day PO  
 Potassium chloride (K-Dur) 40 mEq/day PO  
 Metoprolol (Lopressor) 25 mg PO bid  
 Ondansetron (Zofran) 4 mg IV every 4-6 hours for N/V  
 Transesophageal echocardiogram ASAP

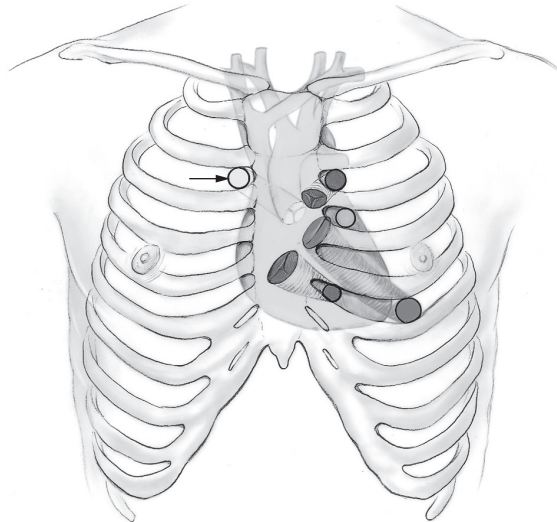
#### Admission Assessment

Blood pressure 152/48 (supine) and 100/40 (sitting)  
 Pulse rate 116 beats/min  
 Respiratory rate 22 breaths/min  
 Temperature 100.2° F (37.9° C)  
 Oriented × 3 but drowsy  
 Grade II/VI holosystolic murmur and a grade III/VI diastolic murmur noted on auscultation  
 Lungs clear bilaterally  
 Abdomen soft with slight left upper quadrant (LUQ) tenderness  
 Multiple petechiae on skin of arms, legs, and chest; splinter hemorrhages under the fingernails;  
 hematuria noted in voided urine

## PART 1 MEDICAL-SURGICAL CASES

chills, fever, fatigue, joint pain, and headache. As you go through the admission process with her, you note that she wears glasses and has a dental bridge. Intravenous (IV) access is obtained with a double lumen peripherally inserted central catheter (PICC) line. Other orders and your assessment are shown in the box.

1. What is the significance of the orthostatic hypotension and tachycardia?  
These findings might indicate hypovolemia secondary to the intractable N/V and furosemide.
2. What is the significance of the abdominal tenderness, hematuria, joint pain, and petechiae?  
Embolization of vegetations from damaged heart valves, with resulting infarction of various organs, is a common complication of endocarditis. Infarction of the spleen can manifest as abdominal tenderness. Infarction of the kidneys causes hematuria and reduced urinary output. Petechiae result from microembolization to small skin vessels, and arthritis from embolization to joints.
3. What are splinter hemorrhages and what is their significance?  
Splinter hemorrhages are red-brown linear streaks located under the fingernails. They are embolic lesions and often occur with infectious endocarditis, although they also appear with trauma to the nails.
4. Mark the area on the accompanying diagram where you would place the stethoscope to auscultate an aortic valve murmur.



5. As you monitor J.F. throughout the day, what other signs and symptoms of embolization will you watch for?
  - Cerebral embolization manifesting with changes in level of consciousness (LOC), visual changes, headache, transient ischemic attacks (TIAs), and stroke
  - Embolization to the extremities manifesting with decreased absent arterial pulses, cool fingers and toes with delayed capillary refill, and cyanosis
  - Coronary artery embolization manifesting with signs of angina, MI, heart failure (HF), or cardiac dysrhythmias
  - Embolization to the bowel manifesting with abdominal pain, cramping, and N/V

6. Explain the diagnostic criteria for infectious endocarditis.

*Positive blood cultures:* These are the prime diagnostic test result, even though definitive results might take a few weeks to obtain if the organisms are slow growing.

*Cardiac murmurs:* Turbulent blood flow through the damaged valves produces murmurs. In J.F.'s case, the holosystolic murmur is caused by blood being forced through the stenotic aortic valve during systole, and the diastolic murmur by backflow of blood from the aorta into the left ventricle through the incompetent aortic valve during diastole (aortic regurgitation). The best way to evaluate these murmurs is through cardiac echocardiography—the transesophageal echocardiogram.

*Fever:* Inflammatory mediators, released in response to the infectious organisms, produce fever.

### CASE STUDY PROGRESS

The next day, you review J.F.'s laboratory test results.

#### Chart View

##### Laboratory Test Results

Na	138 mEq/L
K	3.9 mEq/L
Cl	103 mEq/L
BUN	85 mg/dL
Creatinine	3.9 mg/dL
Glucose	165 mg/dL
WBC	6700/mm <sup>3</sup>
Hct	27%
Hgb	9.0 g/dL

7. Identify the values that are not within normal ranges and explain the reason for each abnormality.

*BUN and creatinine:* Elevated because of the renal failure.

*Glucose:* Elevated in response to the release of stress hormones, particularly catecholamines.

Remember that these were drawn on admission, before the TPN was started.

*Hct and Hgb:* Decreased secondary to renal failure (see previous results) and bleeding into skin and other organs. Low Hct/Hgb are also seen with infectious endocarditis and possibly are caused by anemia of chronic illness.

8. You note that a new intern writes an order for “Fasting blood glucose levels daily.” Is this order appropriate for J.F.? Explain.

Because TPN is given intravenously and continuously, the pancreas is not stimulated to produce insulin as it is with oral nutritional intake. Therefore, glucose has to be monitored to guide the administration of supplemental insulin. With 24-hour TPN, fasting blood glucose levels are not appropriate; usual practice is to check blood glucose levels at the bedside every 6 hours. Some facilities calculate insulin to be given on a sliding scale basis to cover elevated blood glucose levels; some facilities begin insulin drips based on the patient's glucose levels.

## PART 1 MEDICAL-SURGICAL CASES

9. What is the greatest risk for J.F. during the process of rehydration, and what would you monitor to detect its development?

**Inability to oxygenate:** Increased intravascular volume combined with aortic stenosis and regurgitation can cause severe HF. Monitor for crackles, dyspnea, cough with frothy sputum, increased pedal edema, jugular venous distention (JVD), confusion, anxiety, increased drowsiness and lethargy, increased intensity of murmurs, and new S<sub>3</sub>/S<sub>4</sub> heart sounds. Monitor hourly urine output. Because of the patient's history of renal failure, the inability to excrete fluids normally will greatly affect the patient's HF.

## CASE STUDY PROGRESS

You were aware that as soon as J.F. became stable, she would be going home on TPN and IV antibiotics. As part of the discharge preparations, you contact the home care agency that will be providing her care.

10. List five important questions in assessing her home health care needs.
- Is her husband able to help care for her physical needs? Is he home during the day, or does he work? Is he comfortable with tasks such as maintaining the PICC line, TPN administration, pain management, and activities of daily living assistance?
  - Is her husband a good source of emotional support for her?
  - Does she have any other friends or relatives living nearby who would be available for help with physical care or emotional support?
  - What additional assistance will she need from a home health care agency? Regular visits from a registered nurse (RN) for antibiotic and TPN administration, IV maintenance, and pain control? Home health aide? Housekeeper? Occupational therapist or physical therapist?
  - What is the physical setup of her home? Are there stairs she might be too weak to climb? Are there any changes that would make things easier for her, such as converting a downstairs room into a bedroom?
  - What is the family's financial situation? Should a social worker be brought in for consultation?
  - What are J.F.'s emotional and coping needs? Should you involve a psychotherapist in her care?
  - Significant others need to be taught how to measure and administer TPN before she leaves the hospital.

## CASE STUDY PROGRESS

Fortunately, J.F. has a supportive husband and two daughters who live nearby who can function as caregivers when J.F. is discharged. They, along with J.F., will need teaching about endocarditis. Although J.F. has been ill for several years, you discover that she and her family have received little education about the disease. You prepare a teaching plan for the family.

11. List six things you will teach J.F. and her family.
- Teach J.F. and family proper handwashing technique.
  - Explain the disease process and the purpose of treatment procedures. Include the anatomy and physiology of the disease.
  - Teach her to read a thermometer accurately and to consult a physician regarding a temperature greater than 101° F (38.3° C).
  - Teach the importance of informing dentists and other health care personnel about her history of endocarditis before having any procedures performed and to notify her dentist at the first signs of oral infection or gum disease.
  - Instruct her to carry emergency identification at all times.
  - Teach about actions and side effects of medications.
  - Teach signs and symptoms (S/S) of infection and phlebitis associated with the PICC line.

- Teach S/S of impeded or rapid flow of medication solutions.
  - Teach about the use of the IV pump.
  - Teach care of PICC line for intermittent antibiotic medications (flushing before and after medications).
  - Teach family to document date and time of all infusions started and completed.
  - Teach J.F. and family regarding positioning of site with the PICC line
  - Teach J.F. and family when to contact an on-call RN and/or physician.
12. After you have taught J.F. about oral hygiene, which statement by J.F. reflects a need for further education?
- a. "I will remove my bridge after every meal and clean it thoroughly before replacing it."
  - b. "I will use a water irrigation device to clean my teeth and gums."
  - c. "I will use a soft toothbrush to brush my teeth."
  - d. "I will rinse my mouth thoroughly with water after brushing my teeth."

**Answer: b**

Patients with endocarditis should not use oral irrigation devices or floss their teeth because this might result in bacteremia.

### CASE STUDY PROGRESS

Your hospital discharge planner facilitates J.F.'s transition to home care. During the initial home visit, the home health nurse evaluates J.F.'s IV site for implementation of the IV therapy program. The nurse interviews the family members to determine their willingness to be caregivers and their level of understanding and enlists the patient's and family's assistance to identify goals.

13. The home health nurse also writes short- and long-term goals for J.F. and her family. Identify two short-term and three long-term goals.

**Short-term goals:**

- J.F. receives ordered solution and medications without complications.
- J.F. has a patent PICC line.
- J.F.'s family is able to support her care at home.

**Long-term goals:**

- Vital signs are normal (afebrile).
- Infection is resolved.
- Adequate hydration is achieved.
- Fluid and electrolyte status is within normal limits for J.F.
- Renal function is restored (failure resolved).
- Cardiac function is restored (failure resolved).

### CASE STUDY OUTCOME

Mr. F. and his two daughters learned to administer J.F.'s antibiotic and 8-month treatment of TPN. J.F.'s endocarditis resolves with no worsening of her cardiac condition.







## Case Study 13 Coronary Artery Disease and Coronary Artery Bypass Surgery

**Difficulty:** Advanced

**Setting:** Hospital

**Index Words:** coronary artery disease (CAD), heart failure (HF), coronary artery bypass graft (CABG), cardiac catheterization, hemodynamic monitoring, laboratory values, medications, assessment

**Giddens Concepts:** Clinical Judgment, Coping, Gas Exchange, Patient Education, Perfusion

**HESI Concepts:** Assessment, Clinical Decision Making—Clinical Judgment, Gas Exchange, Patient Education, Perfusion, Stress & Coping

### ► Scenario

Your patient, 58-year-old K.Z., has a significant cardiac history. He has long-standing coronary artery disease (CAD) with occasional episodes of heart failure (HF). One year ago, he had an anterior wall myocardial infarction (MI). In addition, he has chronic anemia, hypertension, chronic renal insufficiency, and a recently diagnosed 4-cm suprarenal abdominal aortic aneurysm. Because of his severe CAD, he had to retire from his job as a railroad engineer about 6 months ago. This morning, he is being admitted to your telemetry unit for a same-day cardiac catheterization. As you take his health history, you note that his wife died a year ago (at about the same time that he had his MI) and he does not have any children. He is a current cigarette smoker with a 50-pack-year smoking history. His vital signs (VS) are 158/94, 88, 20, and 97.2° F (36.2° C). As you talk with him, you realize that he has only a minimal understanding of the catheterization procedure.

- Before he leaves for the catheterization laboratory, you briefly teach him the important things he needs to know before having the procedure. List five priority topics you will address.
  - The purpose of the procedure
  - How he will be prepared for the procedure
  - What to expect during the catheterization itself (what the cathlab will look like; sensations he may feel during the procedure, such as a feeling of heat or a hot flash, or palpitations; that someone will be applying pressure to the groin to prevent bleeding after the procedure)
  - What routine monitoring to expect after the procedure, and that he will have to stay in bed for 4 to 6 hours after the procedure, with the procedure leg flat and possible pressure with a sandbag over the insertion site
  - Which staff members will be present to support him
  - Possible complications, and how they will be prevented or managed
- Look at his past history. What other factors are present that could contribute to his risk for cardiac ischemia?
 

Factors that may contribute to a higher risk for cardiac ischemia are K.Z.'s chronic anemia and his smoking, which causes vasoconstriction and maintains a higher level of circulating carbon monoxide in his red blood cells (RBCs).

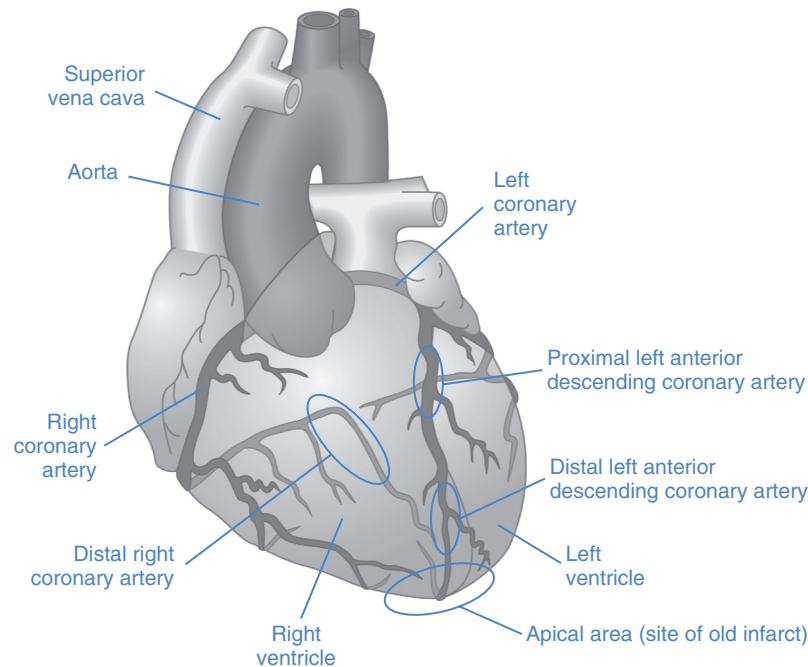
### CASE STUDY PROGRESS

Several hours later, K.Z. returns from his catheterization. The catheterization report shows 90% occlusion of the proximal left anterior descending (LAD) coronary artery, 90% occlusion of the distal LAD, 70% to 80% occlusion of the distal right coronary artery (RCA), an old apical infarct, and an ejection fraction (EF) of 37%. About an hour after the procedure is finished, you perform a brief physical assessment and note a grade III/VI systolic ejection murmur at the cardiac apex, crackles bilaterally in the lung bases, and trace

## PART 1 MEDICAL-SURGICAL CASES

pitting edema of his feet and ankles. Except for the soft systolic murmur, these findings were not present before the catheterization.

- Using the following diagram, identify the superior vena cava, the aorta, and the left and right ventricles. Identify the main coronary arteries, and circle the areas of the LAD and RCA that have significant occlusion, as identified in the previous report. Lightly shade the area of the heart where K.Z. had the earlier infarct.



- What is your evaluation of the catheterization results?  
**He has severe occlusion of two major coronary arteries (RCA, LAD), meaning that much of his ventricular muscle is without adequate blood supply. The old apical infarct is now tough, noncontractile scar tissue. The coronary occlusions and scar tissue contribute to the low EF. An EF of 37% indicates that his left ventricle has lost almost half of its ability to pump blood.**
- Explain the significance of having an EF of 37%.  
**The ejection fraction is the percentage of blood that is ejected from the heart during systole. EF in a normal heart is 50% to 70%. When it drops to below 40%, it indicates left ventricular HF and a serious drop in cardiac output (CO) from the left ventricle having lost much of its pumping ability. This is especially important because this is the "working ventricle" that pumps blood throughout the body.**
- What problem do the changes in assessment findings suggest to you? What led you to your conclusion?  
**K.Z. is developing HF with valve involvement. He has crackles in bilateral bases, pitting edema in his lower extremities, and a systolic ejection murmur (indicating valve involvement).**
- List five actions you should take as a result of your evaluation of the assessment, and state your rationales.
  - Take K.Z.'s VS and continue taking them every 15 minutes. K.Z. is experiencing some sudden changes in his cardiovascular status that require close monitoring.
  - Ask him about symptoms relevant to HF such as shortness of breath and anxiety. Subjective reports of how the patient feels (symptoms) supplement the objective data (signs) obtained by your assessment.

- Note K.Z.'s mental status. Is he restless, confused, or lethargic? Mental status is a good indicator of cerebral perfusion and hypoxemia. Watch carefully for changes.
- Determine his need for supplemental oxygen. Initiate oxygen therapy if needed. The crackles indicate the development of pulmonary edema and potential need for oxygen.
- Call the physician immediately, and report the previous findings.

### CASE STUDY PROGRESS

After assessing K.Z., the physician admits him with a diagnosis of CAD and HF for coronary artery bypass graft (CABG) surgery. Significant laboratory results drawn at this time are Hct 25.3%, Hgb 8.8 g/dL, BUN 33 mg/dL, and creatinine 3.1 mg/dL. K.Z. is given furosemide (Lasix) and 2 units of packed red blood cells (PRBCs).

8. Review K.Z.'s health history. Can you identify a probable explanation for his chronic renal insufficiency and anemia?

If the perfusion to the kidneys is poor over a prolonged period, renal insufficiency develops. One major cause of chronic, poor perfusion to his kidneys may be renal artery vascular disease promoted by his long-term smoking habit. In addition, poorly perfused kidneys are not able to produce adequate amounts of erythropoietin, an important factor stimulating RBC production. This contributes to a chronic anemic condition.

9. Why is he receiving 2 units of PRBCs? What is the purpose of the furosemide?

K.Z. was anemic, and RBCs are necessary to carry oxygen and remove carbon dioxide. The furosemide is a diuretic and is given to help K.Z. eliminate excess fluid and decrease the risk of exacerbating the HF with the PRBC transfusions.

### CASE STUDY PROGRESS

Five days later, after his condition is stabilized, K.Z. is taken to surgery for a three-vessel coronary artery bypass graft (CABG×3V). When he arrives in the surgical intensive care unit (SICU), he has a Swan-Ganz catheter in place for hemodynamic monitoring and is intubated. He is put on a ventilator at  $F_{iO_2}$  0.70 and positive end-expiratory pressure (PEEP) at 5 cm  $H_2O$ . His latest Hgb is 10.3 mg/dL. You review his first hemodynamic readings and arterial blood gases.

### Chart View

#### Hemodynamic Readings

Pulmonary artery pressure (PAP)	38/23 mm Hg
Central venous pressure (CVP)	16 mm Hg
Pulmonary capillary wedge pressure (PCWP)	18 mm Hg
Cardiac index (CI)	1.88 L/min/mm <sup>2</sup>

#### Arterial Blood Gases

pH	7.37
Paco <sub>2</sub>	46 mm Hg
Pao <sub>2</sub>	61 mm Hg
Sao <sub>2</sub>	85%

## PART 1 MEDICAL-SURGICAL CASES

10. Why are arterial blood gases necessary in K.Z.'s case? Explain why it would be inappropriate to use pulse oximetry to assess his O<sub>2</sub> saturation status.  
 Arterial blood gas analysis, including Pao<sub>2</sub>, Paco<sub>2</sub>, pH, and acid-base balance, provides a more complete picture of a patient's respiratory status.
11. What is your interpretation of his arterial blood gases on 70% oxygen?  
 His acid-base balance is normal, but he is not oxygenating adequately. His Pao<sub>2</sub> and Sao<sub>2</sub> are both below normal and should be much higher on 70% oxygen and PEEP. Keep in mind, too, that the overall oxygen-carrying capacity of his blood is low, as evidenced by the low Hgb level.
12. What is your evaluation of K.Z.'s hemodynamic status, based on the results displayed?
- PAP is slightly high (normal 15 to 28 mm Hg systolic/5 to 16 mm Hg diastolic).
  - CVP is slightly elevated (normal 2 to 14 mm Hg).
  - PCWP is slightly high (normal 6 to 15 mm Hg).
  - CI is low (normal 2.8 to 4.2 L/min/mm<sup>2</sup>).
- Clinically, these values show that the pressures within his heart and lungs are a little high and that his CO is a little low. Both of these findings indicate that his heart is still having difficulty pumping out all of the blood that is returned to it and/or that he is a little fluid overloaded. His condition will require careful monitoring.
13. Do you think the hemodynamic values reported previously reflect poor left ventricular function or fluid overload, and why?  
 Poor left ventricular function. If K.Z. were fluid overloaded and had adequate ventricular function, all of the numbers would be elevated. A decrease in CI and an elevation of the rest of the values indicate poor left ventricular function.
14. K.Z. is receiving continuous IV infusions of norepinephrine (Levophed) and dobutamine. Why is K.Z. receiving these medications?  
 To increase CO. The norepinephrine is a vasopressor that increases central blood pressure, thereby increasing myocardial oxygenation and decreasing the workload on the heart. Dobutamine stimulates myocardial adrenergic receptors, thereby increasing CO without significantly increasing heart rate.
15. What are your responsibilities when administering norepinephrine and dobutamine to K.Z.?
- Monitor the efficacy and side effects of both drugs.
    - Norepinephrine enhances myocardial force, thus increasing CO. The major side effects of norepinephrine are anxiety, bradycardia, and palpitations.
    - The desired effects of dobutamine are increased CO and stroke volume and decreased PCWP and systemic vascular resistance (SVR). The major side effects of dobutamine are hypertension and hypotension, palpitations, dysrhythmias (particularly tachycardia and premature ventricular contractions), nausea and vomiting, and dyspnea.
  - Monitor urine output.
  - Monitor blood pressure continuously and maintain per ordered parameters.
  - Monitor ECG continuously, watching for dysrhythmias.
  - Maintain the integrity of the IV and monitor the IV site closely for signs of infiltration. Infiltration of these vasopressors may lead to tissue necrosis and sloughing.

**CASE STUDY PROGRESS**

After 3 days in the SICU, K.Z.'s condition was stable, and he was returned to your telemetry floor. Now, 5 days later, he is ready to go home, and you are preparing him for discharge.

16. List at least four general areas related to his CABG surgery in which he should receive instruction before he goes home.

*What to watch for, what to do if these situations occur, and when to call the physician. This would include S/S infection, HF, problems with bleeding, and difficulty breathing.*

*Medications: How to use them, why he needs them, and what possible side effects to be aware of.*

*Diet: Guidelines for lifestyle changes. In specific patient populations, this is considered a specialized activity. Obtain a consultation for medical nutrition therapy with a registered dietitian.*

*Activity: Guidelines for lifestyle changes. Daily exercise as permitted by the physician. When he can resume driving; lifting restrictions. Enrollment in a cardiac rehabilitation program would be very helpful to his recovery.*

*Mental status: What to expect with regard to mood swings and changes in short-term memory.*

*Resources: The availability of resources in his community, particularly cardiac rehabilitation centers and smoking cessation programs. It is critical that this man quit smoking!*

*Community resources: These will be particularly important for K.Z. because he is without a wife and children for support.*





## Case Study 14 Angina

**Difficulty:** Intermediate

**Setting:** Hospital, intensive care unit

**Index Words:** angina, anxiety, rule out myocardial infarction, assessment, differential diagnosis, diagnostic tests, symptom assessment, laboratory values, geriatric, electrocardiogram (ECG) strip, aspirin therapy

**Giddens Concepts:** Anxiety, Care Coordination, Pain, Patient Education, Perfusion

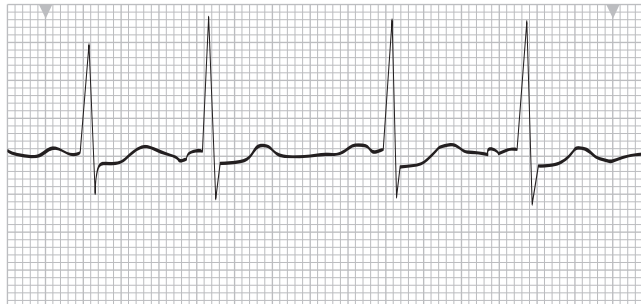
**HESI Concepts:** Anxiety, Assessment, Care Coordination, Pain, Patient Education, Perfusion

### ► Scenario

R.K. is an 85-year-old woman who lives with her husband, who is 87. Two nights before her admission to your cardiac unit, she awoke with heavy substernal pressure accompanied by epigastric distress. The pain was reduced somewhat when she rolled onto her side but did not completely subside for about 6 hours. The next night, she experienced the same chest pressure. The following morning, R.K.'s husband took her to the physician and she was subsequently hospitalized to rule out myocardial infarction (MI). Laboratory specimens were drawn in the emergency department. She was given an intravenous (IV) line, oxygen (O<sub>2</sub>) at 2 L via nasal cannula, and 325 mg chewable, non-enteric-coated aspirin.

You obtain the following information from your history and physical examination: R.K. has no history of smoking or alcohol use, and she has been in good general health, with the exception of osteoarthritis of her hands and knees and some osteoarthritis of the spine. Her only medications are simvastatin (Zocor), ibuprofen as needed for bone and joint pain, and “herbs.” Her admission vital signs (VS) are blood pressure 132/84 mm Hg, pulse 88 beats/min, respirations 18 breaths/min, and oral temperature 99° F (37.2° C). Her weight is 114 lb and height is 5 ft, 4 in. Moderate edema of both ankles is present; capillary refill is brisk and peripheral pulses are 1+. You hear a soft systolic murmur. She denies any discomfort at present. You place her on telemetry, which shows the rhythm in the following figure.

1. Identify her cardiac rhythm.



Sinus rhythm, with premature atrial contractions (PACs). No ventricular ectopy.

2. Give at least two reasons for inserting an IV line.  
To have IV access in case of cardiac arrest, for bolus fluid administration, and for administration of IV nitroglycerin (NTG) or other medications as needed.
3. Explain the purpose of the aspirin tablet. Why is “non-enteric-coated” aspirin specified? What would be a contraindication to administering aspirin?
  - Aspirin is effective in reducing mortality in MI.
  - An enteric coating slows down the availability of the aspirin, and in this case it is desirable for the medication to be rapidly absorbed for rapid availability in the bloodstream. Chewing the tablet also enhances the absorption.

## PART 1 MEDICAL-SURGICAL CASES

- Contraindications would include allergy to aspirin, active major bleeding or major bleeding within the past 2 weeks, hemorrhagic stroke, active or recent gastric bleeding, ulcer disease, and acute bronchospasm.

4. What additional history and physical information should you obtain related to her admitting diagnosis? Name at least four for each.

## History

- Medication allergies.
- Pain, fatigue, or dyspnea (if present) and whether there have been recent changes in any of them: Assess intensity, characteristics, onset, location, duration, what makes it better or worse, associated symptoms, and possible radiation of pain.
- Herbal products: Try to identify exactly what herbs she takes, the implications for interaction with her current medications, and her complaints.
- General activity level: Especially focus on changes in housework or increased fatigue or symptoms during housework in women.
- Sleep patterns.
- General perceived stress level and coping mechanisms.
- Accustomed diet.
- What type of help that she and her husband need at home to stay independent.

## Physical Examination

- Cardiac sounds: Listen for  $S_1$  and  $S_2$  and for additional sounds such as  $S_3$ ,  $S_4$ , valvular click, or rub. Listen to the heart murmur, and identify quality and intensity and whether the extra sound occurs during systole or diastole.
- Jugular venous distention (JVD): This is an indication of elevated right atrial pressure, which can be elevated in severe heart failure (HF) and fluid overload.
- Lungs: Assess for signs and symptoms of HF. Early-stage HF cough is a persistent, dry hack; end-stage HF features crackles, dyspnea, and cough productive of frothy sputum.
- Mental status: Assess for orientation, alertness, anxiety, confusion, and restlessness.

5. List seven laboratory or diagnostic tests you would expect to be performed; suggest what each might contribute.

- Twelve-lead electrocardiogram (ECG): To determine whether R.K. has had a prior MI, whether she is showing ischemic changes and in what part of her heart, and whether she is having irregular rhythms. (ECG is not an exclusive test for MI.)
- Chest x-ray (CXR): To see whether the heart (cardiac silhouette) is enlarged or whether there might be any visible structural problems or defects that are contributing to her symptoms. Check for pulmonary edema.
- Oxygen saturation: To determine whether her symptoms might be related to a respiratory disorder or whether her heart is able to adequately pump blood through her lungs.
- Cardiac enzymes: Creatine phosphokinase with isoenzymes if elevated and troponin T or I to determine whether she has had an MI.
- Complete blood count (CBC) with differential: To check for anemia or infection.
- D-dimer test to rule out pulmonary embolus.
- Metabolic or chemistry panel, or acute care panel, including serum lipid panel urinalysis (UA).
- Prothrombin time/international normalized ratio (PT/INR) and partial thromboplastin time (PTT): To examine for basic coagulation disorders.



6. What other sources, in addition to cardiac ischemia, might be responsible for her chest and abdominal discomfort?

*Gastrointestinal:* indigestion, gastritis, hiatal hernia, reflux esophagitis, gastroesophageal reflux disease (GERD), gallbladder disease, esophageal spasm, peptic ulcer disease (PUD)

*Respiratory:* pleurisy, pulmonary embolism, pneumonia, pneumothorax

*Cardiac:* vasospastic angina, mitral valve prolapse (MVP), severe aortic stenosis, cardiac dysrhythmia, pericarditis

*Musculoskeletal:* rib fracture, costochondritis, respiratory muscle strain, vertebral fractures or compression resulting in nerve impingement

*Metabolic:* anemia, carbon monoxide toxicity

*Psychosocial:* anxiety or stress, panic attack

7. Define the concept of *differential diagnosis* and explain how the concept applies to R.K.'s symptoms.

*Differential diagnosis* is the medical process of discovering which of a number of possible diseases or conditions is responsible for the symptoms the patient has. The clinical process of making a differential diagnosis involves a systematic comparison and contrast of clinical findings. Tests are done to differentiate and eliminate (as in a process of elimination). In this case, it means to distinguish R.K.'s symptoms as cardiac versus noncardiac.

R.K.'s symptoms could come from several sources, some serious and life-threatening, some less significant. By performing a careful assessment and a series of diagnostic tests, the physician can rule out what the diagnosis is *not* by a process of elimination. After the physician narrows the possibilities, the diagnosis usually is whatever is left.

### CASE STUDY PROGRESS

After some rest, R.K.'s chest pain has subsided, and she tells you she feels much better now. You review her laboratory results.

### Chart View

#### Laboratory Results

12-lead ECG: Light left-axis deviation, normal sinus rhythm with no ventricular ectopy

Serial CPK tests are 30 units/L at admission, 32 units/L 4 hours after admission

Cardiac troponin T is less than 0.01 ng/mL (at admission) and same result 4 hours after admission

Cardiac troponin I is less than 0.03 ng/mL (at admission) and same result 4 hours after admission

D-dimer test result less than 250 ng/mL

8. On the basis of the information presented so far, do you believe she had an MI? What is your rationale?

**No.** Her cardiac symptoms are probably a result of angina secondary to coronary artery disease (CAD) rather than an MI, based on the following:

- Cardiac enzymes are within the normal range (for a female patient, 30 to 235 units/L). In the presence of myocardial damage, CK-MB levels would rise 3 to 6 hours after infarction occurs and would peak at 12 to 24 hours (if no further infarction occurs), then return to normal 12 to 48 hours after infarction. CK-MB levels are not usually elevated with angina. Cardiac troponins typically become elevated within 2 to 3 hours after an MI.
- The ECG did not show ST, T wave, or Q wave changes.
- Decreased activity and change of position somewhat relieved pain.

## PART 1 MEDICAL-SURGICAL CASES

9. Do you think she may have a pulmonary embolus?  
The D-dimer test results rule out the occurrence of a pulmonary embolus.
10. While you care for R.K., you carefully observe her. Identify two possible complications of coronary artery disease (CAD) and the signs and symptoms associated with each.
- Cardiac ischemia
  - Cardiac dysrhythmias, particularly premature ventricular contractions: dysrhythmias seen on telemetry, syncope, lightheadedness, shortness of breath, palpitations felt by patient
  - HF: crackles; dyspnea; confusion; dry, hacking, nonproductive cough; peripheral edema; JVD
11. R.K. rings her call bell. When you arrive, she has her hand placed over her heart and tells you she is “having that heavy feeling again.” She is not diaphoretic or nauseated, but states she is short of breath. What else do you assess, and what can you do to make her more comfortable?
- Assess her VS, including pulse oximetry, and cardiac rhythm on telemetry.
  - Order a STAT ECG.
  - Give her supplemental oxygen as ordered (2 to 4 L/min. by nasal cannula) if she is not wearing it.
  - Give her sublingual NTG 0.4 mg as ordered (1 q5min prn chest pain × 3 doses) to decrease the venous return to the heart and dilate the coronary arteries to increase the O<sub>2</sub> supply to the heart.
  - Obtain an order for 30 mL aluminum hydroxide/magnesium hydroxide (such as Maalox) to rule out GERD.
  - Have her rest quietly in bed to decrease O<sub>2</sub> demand.
  - Elevate the head of the bed to facilitate respiratory expansion.
  - Encourage verbalization of concerns to decrease anxiety and O<sub>2</sub> demand.

## CASE STUDY PROGRESS

During the episode of chest pain, R.K.'s vital signs were as follows: pulse 110 beats/min; blood pressure 140/92 mm Hg, respirations 20 breaths/min. The rhythm strip shows sinus tachycardia, and she was very anxious. Her chest discomfort subsided in 3 minutes after one nitroglycerin dose, and she is resting quietly with O<sub>2</sub> per nasal cannula at 2 L/min. R.K.'s physician is making rounds.

12. Using SBAR (Situation, Background, Assessment, Recommendation), how would you communicate this episode to R.K.'s physician?  
You would first need to identify yourself and the patient. Then describe the situation, focusing on the vital signs and the episode of chest pain. Relate that a STAT ECG was obtained and provide a copy. State that you placed R.K. on oxygen and gave her 1 sublingual nitroglycerin tablet. Conclude your remarks by stating that the chest pain subsided after the single dose of nitroglycerin and that you noted that she may need an order for something to reduce her anxiety.

## CASE STUDY PROGRESS

R.K.'s husband is upset. He tells you they have been married for 62 years and he doesn't know what he would do without his wife. One way to help people deal with their anxieties is to help them focus on concrete issues.

13. What information would be useful to get from him? What other health care professional might be able to help with some of these issues?
- Support systems: Do they have any relatives or resources, such as a church, that can help them with things such as meals, shopping, and housekeeping?
  - What is their economic status? Can they afford any long-term help or medications she might need?

- A social worker might be able to help them access community resources and make appropriate referrals.
- Spiritual support: Do they have a minister to call, or would Mr. K. like to have the hospital chaplain visit him?

**CASE STUDY PROGRESS**

R.K. has no further episodes of chest pain, and she is discharged to home the next day. She is to see a cardiologist this week and set up an appointment for outpatient testing. As you present the discharge instructions, you review the proper technique for taking sublingual nitroglycerin for chest pain.

14. Which statement by R.K. indicates that further teaching is needed?
- a. “At the first sign of chest discomfort, I will stop what I’m doing and sit down.”
  - b. “I will place one nitroglycerin tablet under my tongue.”
  - c. “If the chest pain does not stop, I can take another tablet in 5 minutes.”
  - d. “My husband will need to call 911 if the chest pain does not stop after three nitroglycerin tablets.”

**Answer: d**

Current guidelines state that if chest discomfort or pain is unimproved or worsening 5 minutes after one nitroglycerin dose has been taken, then the patient or family member needs to access the emergency medical system (EMS) immediately.





## Case Study 15 Rule Out Myocardial Infarction

**Difficulty:** Intermediate

**Setting:** Hospital emergency department

**Index Words:** rule out myocardial infarction (R/O MI), substance abuse, coronary artery disease (CAD), hypertension (HTN), angina, crisis management, risk factors, laboratory values, medications

**Giddens Concepts:** Addiction, Clinical Judgment, Coping, Pain, Perfusion

**HESI Concepts:** Addiction, Assessment, Clinical Decision Making—Clinical Judgment, Pain, Perfusion, Stress & Coping

### ► Scenario

The time is 1900. You are working in a small, rural hospital. It has been snowing heavily all day, and the medical helicopters at the large regional medical center, 4 hours away by car (in good weather), have been grounded by the weather until morning. The roads are barely passable. W.R., a 48-year-old plumber with a 36-pack-year smoking history, is admitted to your floor with a diagnosis of rule out myocardial infarction (R/O MI). He has significant male-pattern obesity (“beer belly,” large waist circumference) and a barrel chest and reports a dietary history of high-fat food. His wife brought him to the emergency department after he complained of unrelieved “indigestion.” His admission vital signs (VS) were blood pressure (BP) 202/124 mm Hg, pulse (P) 106 beats/min, respirations 18 breaths/min, and oral temperature 98.2° F (36.8° C). W.R. was put on oxygen (O<sub>2</sub>) by nasal cannula (NC) titrated to maintain SpO<sub>2</sub> over 92% and started on an IV nitroglycerin (NTG) infusion. He was given aspirin 325 mg to chew and swallow and was admitted to Dr. A.’s service. There are plans to transfer him by helicopter to the regional medical center for a cardiac catheterization in the morning when the weather clears. Meanwhile, you have to deal with limited laboratory and pharmacy resources. The minute W.R. comes through the door of your unit, he announces he’s “just fine” in a loud and angry voice and demands a cigarette. He also says he has no time to fool around with hospitals.



1. What is the first priority in his care?

**The first priority is his safety. That means maintaining cardiac tissue perfusion and, if he has had an MI, keeping him alive and limiting cardiac damage.**

2. Are these VS reasonable for a man of his age? If not, which one(s) concern(s) you? Explain why or why not.

**His blood pressure (BP is dangerously high, and his pulse (P is rapid for a 48-year-old man who is at rest. Both of these can contribute to myocardial ischemia.**

3. Identify five priority problems associated with the care of a patient such as W.R.

**BP control: Monitor for efficacy of medication and side effects.**

**Myocardial ischemia: This results from (1) increased oxygen demand because of increased cardiac output (high BP and P); (2) probable decreased oxygen availability related to coronary artery disease (CAD) and/or chronic obstructive pulmonary disease (COPD); and (3) possible decreased diffusion of gases across the alveolar-capillary membrane. The last two issues are directly related to his smoking history as well as a possibly obstructed coronary artery.**

**Cigarette smoking: He is going to want to smoke. Smoking negatively affects the heart because of the increased stress on the lungs and the vasoconstriction that restricts oxygenation. You need to caution him about not smoking during his stay in the hospital, and ask his wife to take his cigarettes and lighter or matches home with her.**

**Teaching needs: Teach him to report any chest pain or discomfort or difficult breathing.**

**Pain control: Pain will increase his anxiety and the heart rate, which increases the workload of the heart and myocardial tissue perfusion.**

## PART 1 MEDICAL-SURGICAL CASES

*Cardiac dysrhythmias:* These increase the possibility of sudden death.

*Constipation:* His high-fat, low-fiber dietary preferences and decreased activity during hospitalization increase his risk for constipation; the pattern of breath-holding during a bowel movement is termed the Valsalva maneuver. In cardiac patients who are constipated, it can precipitate an MI or sudden death.

*Hostility:* His anger is probably masking fear of death and fear of loss of control, which can contribute to more stress on his heart and would be dangerous at this time. Consider an antianxiety agent at this time.

*Denial:* His denial is a coping mechanism related to his fear. Although denial sometimes serves a positive purpose, in this situation it is contributing to behaviors that increase W.R.'s risk for cardiac damage.

4. Which laboratory tests might be ordered to investigate W.R.'s condition? If the order is appropriate, place an *A* in the space provided. If inappropriate, mark with an *I*. Provide rationales for your decisions.

- \_\_\_ 1. Complete blood count (CBC)
- \_\_\_ 2. Electroencephalogram (EEG) in the morning
- \_\_\_ 3. Basal metabolic panel (BMP)
- \_\_\_ 4. Prothrombin time (PT) and partial thromboplastin time (PTT)
- \_\_\_ 5. Bilirubin
- \_\_\_ 6. Urinalysis (UA)
- \_\_\_ 7. STAT 12-lead electrocardiogram (ECG) and repeat in the morning
- \_\_\_ 8. Type and crossmatch for 2 units of packed red blood cells (PRBCs)
- \_\_\_ 9. Chest x-ray on admission and in the morning

Answers: 1. *A*; 2. *I*; 3. *A*; 4. *A*; 5. *I*; 6. *A*; 7. *A*; 8. *I*; 9. *A*

The CBC, BMP, PT and PTT, and UA are appropriate admitting laboratory tests for all patients with BP disorders. The STAT 12-lead ECG is appropriate for this patient because his heart is involved. The chest x-ray will provide information about pulmonary and cardiac status. The EEG, bilirubin, and type and crossmatch are not appropriate for this patient.

5. What significant laboratory tests are missing from the previous list?

Serial cardiac enzymes; the order should read creatine kinase (CK), troponin T and I q8h. In addition, a D-dimer test should be ordered to rule out pulmonary embolus. A fasting lipid panel in the morning is needed to evaluate lipid levels.



6. How are you going to respond to W.R.'s angry demands for a cigarette? He also requests something for his "heartburn." How will you respond?
- Address his feelings of loss of control by acknowledging his legitimate issues of craving (cigarettes) and pain or discomfort. Assure him you will call the physician and get something to help him feel more comfortable.
  - Explain that smoking could cut off oxygen to his heart and increase his pain, burning, or discomfort (use his choice of words).
  - Reassure him that you will be available if he needs help.
  - Offer him a choice by asking him whether he would like an antacid (such as Maalox or Mylanta, which are combination products that contain aluminum and magnesium) per your unit protocol for his heartburn while you contact the physician. Ask whether there is anything else you can do to make him more comfortable. (No, he still can't smoke.)
  - Remind him that lit cigarettes are not safe when oxygen is being delivered by NC.
  - Professional confidence and competence communicate themselves to people experiencing fear and help meet their need for security.

7. Mrs. R. asks you, "If he can't smoke, why can't you give him one of those nicotine patches?" How will you respond?

Explain that use of the nicotine patch should be avoided in patients with severe angina or uncontrolled hypertension (HTN) and for 8 weeks after an MI. Nicotine in the patch will constrict his coronary arteries and might decrease blood flow and oxygen to his heart. At this time his condition is unstable, and it is best not to risk these adverse effects.

8. Are there any alternatives to help him with his nicotine cravings? Would they be helpful now?

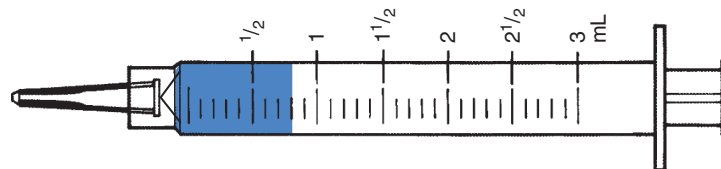
Bupropion (Zyban) is an antidepressant that is used for smoking cessation. Varenicline (Chantix) is another drug that can be used for smoking cessation. However, these drugs take several weeks to have any effect on nicotine cravings. It may be useful to give him a mild anti-anxiety medication such as alprazolam (Xanax) to help with the cravings.

### CASE STUDY PROGRESS

At 2000, you phone Dr. A.'s partner, who is on call. She prescribes morphine sulfate 4 to 10 mg IV push (IVP) q1h prn for pain (burning, pressure, and angina).

9. Explain two reasons for this order.
- Morphine sulfate, an opioid analgesic, will decrease pain and help reduce his stress.
  - Morphine sulfate functions to dilate pulmonary vessels and decrease preload on the heart.
  - Morphine sulfate dilates the coronary arteries to increase blood flow and oxygen delivery and promote tissue perfusion.
  - Relieving pain will help decrease myocardial oxygen demand.
10. What special precautions should you follow when administering morphine sulfate via IVP?
- Ask about prior allergy, hypersensitivity reaction to morphine sulfate, or impaired liver function.
  - Assess VS, especially respirations (do not administer if respirations are less than 10 breaths/min); level of consciousness with opioid use; and location and intensity of pain before and 30 to 60 minutes after administration.
  - Administer IVP over 4 to 5 minutes (for 15 mg or less).
  - Start with smallest dose ordered and titrate to eliminate pain.
11. The pharmacy supplies morphine for injection in vials of 5 mg/mL only. For the first dose, you will be giving 4 mg of morphine. How many milliliters will you give for this dose? Mark the syringe with your answer.

0.8 mL



## PART 1 MEDICAL-SURGICAL CASES

12. What will you do with the rest of the morphine in the vial?

- Discard it.
- Save it for the next dose.
- Return it to the pharmacy.
- Discard it with a second witness.

Answer: d

Morphine is a Schedule II drug, and any drug that is not used needs to be “wasted” with a second witness documenting that the drug was discarded.

13. Angina is not always experienced as “pain” as many people understand pain. How would you describe symptoms you want him to warn you about? Why is this important?

- Tell him you want him to notify you of any unusual or uncomfortable feelings that develop.
- It is possible that he could develop an MI even if he has not already had one. He could also develop lethal dysrhythmias or cardiac arrest.



14. What safety measures or instructions would you give W.R. before you leave his room?

- He should press the nurses' call light as soon as he starts to experience any uncomfortable feelings (the word *pain* might be misunderstood), becomes nauseated, or experiences more “indigestion.”
- Inform him of his activity status—for example, “The doctor has placed you on bed rest with bathroom privileges. That means if you need to use the bathroom, you need to turn on your call light and someone will assist you. Do not try to get up by yourself.”
- It is against hospital policy for him to smoke in the hospital. Have his wife take his cigarettes and lighter or matches home.
- It is very important that he let you know whether he has to have a bowel movement because during a bowel movement the Valsalva maneuver (you might have to explain this) can contribute to sudden death.

15. Mrs. R. is unable to leave the hospital because of the bad weather. She approaches you and asks, “Did my husband have a heart attack? I'm really scared. His father died of one when he was 51.” How are you going to respond to her question?

It is important to recognize and address Mrs. R.'s anxiety. Reassure her that he is getting excellent care and he will be closely monitored. Explain that no one can tell whether he has had a heart attack until the test results come back. Thank her for the additional information, and tell her you will pass it along to the physician. Tell her that he is going to need her help when he goes home so that he can begin to live a healthier lifestyle.

## CASE STUDY PROGRESS

When you come into W.R.'s room at 2230 hours to answer his call light, you see he is holding his left arm and complaining about aching in his left shoulder and arm.

16. What information will you gather? What questions will you ask him?

- Take his VS. Obtain a STAT ECG.
- Evaluate his level of anxiety.
- Perform a focused assessment: Observe his color; feel for diaphoresis.
- Ask about the presence of pain and symptoms: quality; intensity (have W.R. rate his pain on a scale of 1 to 10, with 1 being no pain and 10 being the worst possible pain); location (where did it start, and has it traveled anywhere?); and duration.
- Ask about nausea.



**CASE STUDY PROGRESS**

You titrate the NTG drip up, assess his compliance with the oxygen cannula, and assess his vital signs. In addition, you administer a dose of morphine, but his pain is not relieved. Based on your assessment findings, you decide to call the physician.

17. Using SBAR (Situation, Background, Assessment, Recommendation), what information would you provide to the physician when you call?  
 Following SBAR, you would first identify yourself, then explain that W.R. is complaining about aching in his left shoulder and arm that has been unrelieved by increasing the NTG drip. For background, state that W.R. was admitted at 1900 for R/O MI (patient complaint was unrelieved “indigestion”). He cannot be transported to the larger medical center until the morning because of the weather conditions. Give current VS and pertinent details of his physical examination, including ECG and laboratory results, and any other assessment items that have changed. The assessment of the situation is that W.R. is experiencing angina and possibly an MI. You would anticipate diagnostic testing, medication with IV morphine and nitrates, and close monitoring until he is able to be transported to the medical center.
18. W.R.'s chest pain subsides after the dose of morphine and he settles down for the night. You monitor him closely and watch for side effects of the NTG infusion. Side effects of NTG include which of these? Select all that apply.
- Constipation
  - Headache
  - Tachycardia
  - Postural hypotension
  - Decreased respirations

Answers: b, c, d

Constipation and decreased respirations do not occur with NTG administration but may result from the opioid morphine sulfate.

**CASE STUDY PROGRESS**

In the morning, W.R. is transferred by helicopter to the medical center, and a cardiac catheterization is performed. It is determined that W.R. has coronary artery disease (CAD). The cardiologist suggests it would be best to treat him medically for now.

19. What does it mean to treat him “medically”? What other approaches might be used to treat CAD?  
 Medical management involves several components and is often considered conservative treatment. Adjustment or addition of pharmacologic treatment for coronary risk factors (e.g., hyperlipidemia, HTN) with medications—nitrates, beta-adrenergic blockers, aspirin therapy, “statins” (lipid-lowering agents)—has been shown to reduce mortality and future coronary events. In addition, if a patient's ejection fraction is less than 40%, an angiotensin-converting enzyme (ACE) inhibitor or angiotensin II receptor blocker (ARB) will be needed. Advice about lifestyle modification might be needed (weight loss, smoking cessation, exercise, dietary modifications, alcohol moderation). Other approaches involve surgical procedures: coronary artery bypass graft (CABG), stent placement, percutaneous transluminal coronary angioplasty (PTCA), or balloon angioplasty with stent placement.

**PART 1 MEDICAL-SURGICAL CASES**

**CASE STUDY OUTCOME**

The physician orders follow-up counseling regarding risk factor modification, especially smoking cessation, hypertension management, weight loss, and lipid (cholesterol) management. W.R. is discharged with a referral for a follow-up visit to his local internist in 1 week.



## Case Study 16 Acute Coronary Syndrome

**Difficulty:** Advanced

**Setting:** Emergency department, hospital, home care

**Index Words:** heart failure (HF), coronary artery disease (CAD), arm fracture, communication deficit, cultural diversity, geriatric, laboratory values, therapeutic nutrition, medications, electrolytes

**Giddens Concepts:** Care Coordination, Communication, Culture, Fluid and Electrolyte Balance, Perfusion

**HESI Concepts:** Assessment, Care Coordination, Communication, Cultural/Spiritual, Fluid & Electrolyte, Perfusion

### ► Scenario

You are just getting caught up with your work when you receive the following phone call: “Hi, this is Deb in the emergency department. We’re sending you M.M., a 63-year-old Hispanic woman with a past medical history of coronary artery disease (CAD). Her daughter reports that her mom has become increasingly weak over the past couple of weeks and has been unable to do her housework. Apparently, she has had complaints of swelling in her ankles and feet by late afternoon ‘she couldn’t wear her shoes’ and has nocturnal diuresis  $\times 4$ . Her daughter brought her in because she has had heaviness in her chest off and on over the past few days but denies any discomfort at this time. The daughter took her to see her family physician who immediately sent her here. Vital signs are 146/92, 96, 24, 99° F (37.2° C). She has an IV of D<sub>5</sub>W at 50 mL/hr in her right forearm. Her laboratory results are as follows: Na 134 mEq/L, K 3.5 mEq/L, Cl 103 mEq/L, HCO<sub>3</sub> 23 mEq/L, BUN 13 mg/dL, creatinine 1.3 mg/dL, glucose 153 mg/dL, WBC 8300/mm<sup>3</sup>, Hct 33.9%, Hgb 11.7 g/dL, platelets 162,000/mm<sup>3</sup>. PT/INR, PTT, and urinalysis are pending. She has had her chest x-ray and ECG, and her orders have been written.”

1. What additional information do you need from the emergency department (ED) nurse?
  - What is the patient's admitting diagnosis?
  - Does she speak English? Some facilities state that family members can be used as an interpreter only if the patient gives permission and only if it is documented that an interpreter was offered and refused.
  - Have any cardiac enzymes been drawn?
  - What did her chest x-ray (CXR) examination show? Any changes from the last time? SpO<sub>2</sub>?
  - What medications does she take? Any medication allergies? Was she given any medication in the ED?
  - Does she have diabetes? Keep in mind that people with diabetes sometimes experience atypical chest discomfort, such as heaviness in the chest, instead of the “classic” substernal chest pain.
  - Does she have a history of anemia or any bleeding recently?
  - What are other pertinent assessment findings, such as orientation and voiding?
  
2. How are you going to prepare for this patient?
  - If the patient does not speak English and the daughter is not coming to the unit with her, find out what the hospital's procedures are for finding an interpreter. Many facilities have an interpreter service (such as a telephone language service) and/or a resource list of employees who speak Spanish.
  - Turn the bed down and place an IV pole in her room. Obtain an infusion pump.
  - Make certain a thermometer, blood pressure cuff, and admission pack are in the room.
  - Have a scale in the room to get a baseline weight.
  - Make certain there is a “hat” in the toilet to measure urinary output.

## PART 1 MEDICAL-SURGICAL CASES

3. M.M. arrives by wheelchair. As she transfers to the bed, what observations will you make? Why?
- Before she gets out of the wheelchair, ask her if she can stand to transfer to the bed, and observe her ability to communicate, general skin color, respiratory rate and pattern, and balance and coordination (safety issues for ambulation and self-care). In addition, you will be able to assess her general hygiene status.
  - Place your hands on the patient's skin to note temperature, turgor, and moisture on the skin; this can be done while obtaining initial vital signs (VS).
  - Observe the following as she moves from the wheelchair to the bed: gait, strength of arms and legs, need for assistance, balance, coordination, effort, change in color, change in respiratory pattern as she exerts herself. You can also check her feet for swelling as she transfers from the wheelchair to the bed.
4. Given the previous information, you can anticipate orders for M.M. Carefully review each order to determine whether it is appropriate or inappropriate as written. If the order is appropriate, mark it as *A*; if the order is inappropriate, mark it as *I* and change the order to make it appropriate. Provide any other orders that might be appropriate for M.M.
- 1. Routine VS
  - 2. Serum magnesium (Mg) STAT
  - 3. Up ad lib
  - 4. 10 g sodium (Na), low-fat diet
  - 5. Change IV to a saline lock
  - 6. Cardiac enzymes on admission and q8h × 24 hr, then daily every morning
  - 7. CBC, BMP, and fasting lipid profile in morning
  - 8. Schedule for abdominal CT scan for AM
  - 9. Heparin 10,000 units subcut q8h
  - 10. Docusate sodium (Colace) 100 mg/day PO
  - 11. Ampicillin 250 mg IV piggyback q6h
  - 12. Furosemide (Lasix) 200 mg IV push STAT
  - 13. Nitroglycerin (NTG) 0.4 mg 1 SL q4h prn for chest pain
  - 14. Schedule echocardiogram

## Answers:

1. *I*; VS should be every 4 hours.
2. *A*
3. *I*; activity should be up in chair/ambulate with assistance.
4. *I*; diet should be 2 g sodium (low sodium).
5. *A*
6. *A*
7. *A*
8. *I*; not necessary at this time.
9. *I*; dose should be 5000 units bid.
10. *A*
11. *I*; no current indication for antibiotic therapy.
12. *I*; 200 mg is too large a dose; a dose of 20 to 40 mg might be more appropriate.
13. *I*; dosage for sublingual (SL) NTG if chest pain is present is one tablet SL every 5 minutes, repeat in 5 minutes × 2 if chest pain is not relieved, up to three tablets total. Call the staff on-call physician if no relief after the first tablet; every 4 hours is an incorrect interval.

14. A

Missing orders:

- Obtain 12-lead electrocardiogram (ECG) to note any ischemic changes or rhythm problems. Specify 12-lead ECG.
- Potassium at 3.5 mEq/L. Potassium level is borderline low; should consider adding potassium to the continuous IV solution or giving oral potassium supplementation.
- Based on serum magnesium results, magnesium supplementation might be required.
- Nonenteric aspirin (ASA) 325 mg PO should be given. The initial dose of ASA in the ER should be 325 mg, chewed. Thereafter, the usual dose is 81 mg PO daily.
- Thyroid-stimulating hormone (TSH). Subclinical hypothyroidism is now recognized as a risk factor for heart failure (HF).
- Brain natriuretic peptide (BNP) might be ordered to check for HF.
- Oxygen therapy. Check  $\text{SpO}_2$  and administer oxygen as needed.

5. Which interventions are appropriate for administering subcutaneous heparin? Select all that apply.
- Rotate injection sites with each dose.
  - Monitor activated partial thromboplastin time (aPTT) levels daily.
  - Massage the area after the injection.
  - Give the injection at least 2 inches away from the umbilicus.
  - Do not aspirate the syringe before injecting the heparin.

Answers: a, d, e

Subcutaneous heparin is considered low-dose heparin and is not monitored by aPTT levels. The area should not be massaged after injection; this might lead to increased bruising.

### CASE STUDY PROGRESS

Shortly after admission, M.M.'s call light comes on. When you respond to M.M.'s call light, you observe she is talking rapidly in Spanish and pointing to the bathroom. Her speech pattern indicates she is short of breath; she is having trouble completing a sentence without taking a labored breath. You help her use a bedpan and note that her skin feels clammy. While sitting on the bedpan, she vomits.

6. On a scale of 0 to 10 (0 being no problem, 10 being a code-level emergency), how would you rate this situation, and why?
- 8 or 9: The patient's skin is clammy and she has vomited; these are probable signs of cardiac ischemia and indicate the patient needs immediate medical attention.**
7. Identify at least four actions you should take next, and state your rationale.
- Pull emergency light in the room and call for help. Stay with M.M. You want additional personnel, in case the patient's condition continues to deteriorate. Have your unit's staff call for the rapid response team.
  - Remove the bedpan, if possible, take her VS, and complete a brief assessment of the heart and lungs. You want to determine whether the patient is having dysrhythmias or has abnormal lung sounds.
  - Initiate oxygen (titrate to maintain  $\text{SpO}_2$  over 92%), oximeter monitoring, and cardiac monitoring (if available). Call for a STAT 12-lead ECG.
  - Reassure M.M. as well as possible (tone of voice and touch communicate across language barriers) that you will stay with her and help her. If you do not speak Spanish, ask the unit clerk to STAT page anyone who does or use the hospital's language telephone service.
  - Have someone STAT page M.M.'s physician.

## PART 1 MEDICAL-SURGICAL CASES

- If she has not yet had an aspirin, give her a non–enteric-coated 325-mg aspirin tablet and instruct her to chew it.
- Ask the patient about symptoms. Facilitate understanding with nonverbal signs. Gather as much relevant data as possible to determine whether the patient is manifesting a myocardial infarction (MI), pulmonary edema, pulmonary embolus, and so on.

8. M.M.'s physician calls your unit to find out what is happening. Using SBAR, what information would you need to convey at this time?

Following SBAR (Situation, Background, Assessment, Recommendation), you would first identify yourself, the patient, and her admitting diagnosis. For background, you would tell the physician that the patient speaks Spanish only, and that she was admitted because of heaviness in her chest off and on over the past few days and with signs of HF. Describe how she vomited once she was assisted onto the bedpan and that her skin was clammy; report your assessment findings, VS, and what you have done so far. The assessment of the situation is that M.M. might be experiencing an MI, and you would anticipate a transfer to the coronary care unit and medications to maintain cardiac and respiratory function.

9. The hospital's staff physician is coming to the floor immediately to evaluate the patient. In the meantime she orders furosemide (Lasix) 40 mg IV push STAT. You have only 20 mg in stock. Should you give the 20 mg now, and then give the additional 20 mg when it comes up from the pharmacy? Explain your answer.

Give the 20 mg furosemide to start treatment. However, you should know that response to furosemide is dose related; 20 mg now plus 20 mg later does not equal the same response as 40 mg given at one time. You need to make the physician aware that you gave only 20 mg and ask how much more the physician wants to give when it becomes available. The physician might say, "Give another 20 later" or "Give 40 later when it gets here." Call the pharmacy and have furosemide brought to the floor STAT or send someone to get it.

10. M.M. continues to experience vomiting and diaphoresis that are unrelieved by medication and comfort measures. A STAT 12-lead ECG reveals ischemic changes, and she is transferred to the coronary care unit (CCU). As you give the report to the receiving registered nurse, what laboratory value is the most important to report, and why?

Potassium: The potassium level was 3.5 mEq/L before any furosemide was given; the patient is going to need some potassium supplementation. Also indicate serum magnesium level if the report has come back.

11. You are monitoring while a new nurse prepares to administer IV potassium to M.M. Which technique is correct? Explain why the other answers are incorrect.
- a. Give the IV potassium by slow IV push.
  - b. Add potassium to a hanging IV bag as needed.
  - c. The rate of IV administration should not exceed 10 mEq/hr.
  - d. Administer the IV potassium by gravity drip.

Answer: c

Intravenous potassium is always diluted and never given by IV push. Never add potassium to a hanging IV bag; this may result in giving a bolus dose if the bag is not mixed sufficiently. Always use an infusion pump when administering IV potassium.

**CASE STUDY PROGRESS**

While recovering in the CCU, M.M. tried to get up out of the bed, fell, and fractured her right humerus. Because of the surgical risks involved, M.M. was treated conservatively and put in a full arm cast. She is transferred back to your floor.

**CASE STUDY PROGRESS**

A case manager (CM) has been asked to evaluate M.M.'s home to see whether she can be discharged to her own home or will need to stay in a long-term care facility.

12. Identify at least eight things that the CM would assess.
  - What sort of support will she have at home for activities of daily living (ADLs), self-care, home maintenance, and so on?
  - Is there telephone service?
  - How many steps are in the home or apartment? Are her bedroom and a bathroom downstairs?
  - Is there a danger of tripping on throw rugs, loose carpeting, and so on?
  - Are there handrails in stairways?
  - How wide are the doorways?
  - Where are the bathrooms? Does she have to negotiate steps to get there?
  - Can the toilet seat be raised and railings applied?
  - Is the lighting adequate?
  - What is she going to do for meals, grocery shopping, and laundry?
  - Can she get to a refrigerator? Will she be able to heat her meals?
  - Will someone check on her every day? Help her with medications?
  - Does she have sufficient lower body strength to ambulate independently and safely?
  - Are there Spanish-speaking health care workers available to work with M.M.?
  
13. M.M.'s nutritional intake over the past few weeks has been poor. She also has increased nutritional needs because of her fractured arm. What are some of the nutritional needs that should be met? What would you recommend to help her with this?
  - It is important that M.M. get a consultation with a registered dietitian (RD) who will assess her additional nutritional needs. This should be completed as soon as possible and certainly before discharge.
  - She is going to need help meeting her increased caloric, protein, calcium, vitamin, and mineral needs to promote healing. The RD can assist with suggesting supplements that can help with intake of these nutrients yet still avoid increasing her sodium and fat intake.
  - Have the family bring food from home.

**CASE STUDY PROGRESS**

Because the case manager determined that M.M. lived in an apartment with poor access, M.M. elects to stay with her daughter and five grandchildren in their small home. A home care nurse comes three times a week to check on her. M.M. is easily fatigued, and the children are quite lively. School is out for the summer.

14. Suggest some ways for M.M.'s daughter to ensure that her mother is not overwhelmed and does not become exhausted in this situation.
  - Even if M.M. can't have her own room, arrange for her to have a quiet corner where she can withdraw as needed.
  - Establish a "nap time" every day when she will not be disturbed.

**PART 1 MEDICAL-SURGICAL CASES**

- Keep the children occupied with a video (or something they would enjoy) to keep them quiet for specific times each day.
- Ask the children who are able to follow directions to take turns helping their grandmother during certain times of the day.
- Ask whether there is a responsible friend or relative with a van or large vehicle who can take M.M. for a brief daily drive or out for a refreshment to help her get out of the house on a regular basis. This is best followed by a nap.





## Case Study 17 Percutaneous Coronary Intervention

**Difficulty:** Advanced

**Setting:** Hospital coronary care unit

**Index Words:** Percutaneous coronary intervention, myocardial infarction (MI), dysfunctional family, domestic violence, ECG, patient education, assessment, oxygenation, medications, laboratory values, assessment of complications after MI

**Giddens Concepts:** Clinical Judgment, Collaboration, Coping, Family Dynamics, Gas Exchange, Interpersonal Violence, Perfusion

**HESI Concepts:** Assessment, Clinical Decision Making—Clinical Judgment, Collaboration/ Managing Care, Family Dynamics, Gas Exchange, Perfusion, Stress & Coping, Violence

### ► Scenario

You are in the middle of your shift in the coronary care unit (CCU) of a large urban medical center. Your new admission, C.B., a 47-year-old woman, was just flown to your institution from a small rural community more than 100 miles away. She had a STEMI (ST segment elevation myocardial infarction) last evening. Her current vital signs (VS) are 100/60, 86, 14. After you make C.B. comfortable, you receive this report from the flight nurse: "C.B. is a full-time homemaker with four children. She has had episodes of 'chest tightness' with exertion for the past year, but this is her first known MI. She has a history of hyperlipidemia and has smoked one pack of cigarettes daily for 30 years. Surgical history consists of total abdominal hysterectomy 10 years ago after the birth of her last child. She has no other known medical problems. Yesterday at 8 PM, she began to have severe substernal chest pain that referred into her neck and down both arms. She rated the pain as 9 or 10 on a 0-to-10 scale. She thought it was severe indigestion and began taking Maalox with no relief. Her husband then took her to the local emergency department, where a 12-lead electrocardiogram (ECG) showed hyperacute ST elevation in the inferior leads II, III, aVF and  $V_5$  to  $V_6$ . Before tissue plasminogen activator could be given, she went into ventricular fibrillation (V-fib). CPR was started and when the code team arrived, she was successfully defibrillated after two shocks. She then was started on nitroglycerin (NTG), heparin, and amiodarone drips. She was given IV metoprolol and aspirin 325 mg to chew and swallow. This morning her systolic pressure dropped into the 80s, and she was placed on a low-dose norepinephrine drip and urgently flown to your institution for coronary angiography and possible percutaneous transluminal coronary angioplasty. Currently, she has amiodarone infusing at 1 mg/min, heparin at 1200 units/hr, and norepinephrine at 0.5 mcg/kg/min. The NTG has been stopped because of low blood pressure. Laboratory work that was done yesterday showed Na 145 mEq/L, K 3.6 mEq/L,  $\text{HCO}_3$  19 mEq/L, BUN 9 mg/dL, creatinine 0.8 mg/dL, WBC 14,500/mm<sup>3</sup>, Hct 44.3%, and Hgb 14.5 g/dL."

1. Because the 12-lead ECG can tell you the location of the infarction, evaluate the leads that showed ST elevation. What areas of C.B.'s heart have been damaged?  
**Leads II, III, and aVF "look at" the heart from below. ST elevation in these leads indicates inferior wall damage. Leads  $V_5$  and  $V_6$  view the heart from the left side. ST elevation in these leads indicates lateral wall damage.**
2. Given the diagnosis of acute myocardial infarction (MI), what other laboratory results are you going to look at?
  - Creatinine kinase (CK) and its isoenzymes; troponins T and I
  - Cholesterol and triglyceride levels: high-density lipoprotein (HDL), low-density lipoprotein (LDL), very-low-density lipoprotein (VLDL) (drawn fasting)
  - Arterial blood gases
  - PT/INR (prothrombin time and international normalized ratio) and PTT (partial thromboplastin time)

## PART 1 MEDICAL-SURGICAL CASES

- Magnesium (Mg)
  - CMP (complete metabolic panel)
3. Indicate the expected outcome for C.B. associated with each medication she is receiving. For each of the drugs listed, state the purpose.
- a. Intravenous (IV) nitroglycerin (NTG)
  - b. IV heparin
  - c. IV amiodarone
  - d. IV metoprolol
  - e. Aspirin, chewed and swallowed
  - f. IV norepinephrine
- a. IV NTG (a coronary vasodilator) is given to dilate coronary arteries and improve collateral blood flow to ischemic areas of the heart muscle. In addition, it causes peripheral vasodilation.
  - b. IV heparin (an anticoagulant) is given to prevent extension of existing thrombi or new clot formation.
  - c. IV amiodarone is given to prevent lethal dysrhythmias, which are common after MI.
  - d. IV metoprolol (a beta-blocker) is given to reduce mortality after MI; it protects the damaged heart from stimulation by circulating catecholamines.
  - e. The aspirin, when chewed and swallowed, is a rapid platelet aggregation inhibitor that helps to prevent clots from forming.
  - f. IV norepinephrine (a vasopressor) is used to correct severe hypotension.

## Chart View

**Laboratory Test Results***Creatine Phosphokinase (CK) Levels*

On ED admission	95 units/L
4 hours	1931 units/L
8 hours	4175 units/L

*CK-MB Isoenzymes*

On ED admission	5%
4 hours	79%
8 hours	216%

LDL	160 mg/dL
PT	11.9 sec
INR	1.02
aPTT (before heparin)	26.9 sec
Mg	2.2 mg/dL
K	3.3 mEq/L

4. You review the lab work on her chart. For each laboratory value listed previously, interpret the result, and evaluate the meaning for C.B.
  - The normal CK level for a female patient should be 30 to 135 units/L; the CK-MB isoenzymes should be 0%. CK is released from several tissues after damage. The MB isoenzyme is specific for damaged cardiac muscle. Because the CK level is proportional to the amount of myocardial injury, CK levels give a good indication of the severity of the MI. C.B. has had a massive MI.
  - LDL: 160 mg/dL with a known coronary disease. The latest National Cholesterol Education Program guidelines recommend an LDL level below 100 mg/dL. C.B.'s LDL level is elevated.
  - The PT/INR and aPTT are within normal limits for someone who is not receiving anticoagulant therapy.
  - Hypomagnesemia can cause cardiac dysrhythmias. The usual goal is to keep serum Mg at 2 mg/dL or greater. C.B.'s Mg level is within normal limits.
  - A common normal reference level for serum potassium is 3.5 to 5 mEq/L. Hypokalemia might lead to increased electrical instability and ventricular dysrhythmias. In light of C.B.'s history of V-fib, it is important to monitor her potassium level and supplement as needed.
  
5. List at least two complications C.B. is at risk for at this time and the assessments that are needed to identify these risks.
  - Dysrhythmias, such as tachycardia or bradycardia, or complete heart block, or life-threatening dysrhythmias such as ventricular tachycardia or fibrillation. Monitor the patient's ECG continuously for any rhythm changes. An increase in premature ventricular contractions (PVCs) may precede ventricular tachycardia and fibrillation.
  - Heart failure (HF) occurs when the ability of the heart to pump has been reduced. The signs and symptoms (S/S) of HF depend on the severity of the damage done to the heart after the MI. Watch for mild dyspnea, agitation, restlessness, or a slight increase in heart rate. As HF progresses, other signs may include crackles on auscultation of the lungs,  $S_3$  or  $S_4$  heart sounds, and jugular vein distention. A chest x-ray examination would reveal pulmonary congestion.
  - Papillary muscle dysfunction occurs if the infarction damages the papillary muscle that attaches to the mitral valve. Assess for a new systolic murmur at the apex. An echocardiogram should be ordered to confirm the diagnosis.
  - Ventricular aneurysm occurs after damage to the left ventricle leaves the ventricle thin; during contractions, the wall bulges out. Monitor the patient for S/S of HF, dysrhythmias, and angina. Ventricular aneurysms may develop thrombi that can lead to emboli and strokes, and rupture of the aneurysm results in death.
  
6. You note that C.B.'s  $\text{SpO}_2$  on oxygen ( $\text{O}_2$ ) at 6 L/min by nasal cannula is 92%. How do you interpret this result?

Ideal  $\text{SpO}_2$  values are 95% to 100%, depending on altitude. Her oxygen saturation on 6 L/min is not adequate!
  
7. What can be done to promote her oxygenation at this time?

Convert the oxygen delivery system to a non-rebreather mask, which will provide a higher percentage (60% to 100%) of oxygen. Elevate the head of her bed, and promote rest. Monitor  $\text{SpO}_2$  values with a goal of 95% to 100%.

## PART 1 MEDICAL-SURGICAL CASES

8. An hour after her admission, you are preparing C.B. for her coronary intervention. Evaluate her readiness for teaching and her learning needs. What would you tell her?
- Be brief in your explanation because she is still in some pain and in an unstable condition. This is not the time to go into lengthy anatomy and physiology discussions. Her biggest problem right now probably is fear.
  - Briefly explain that this is a common procedure, and the physicians do many of these every day. Tell her that the purpose is to restore blood flow to her narrowed (stenosed) coronary artery by inserting a stent. She will be taken to the cardiac catheterization laboratory where the stent insertion will be performed. Tell C.B., "During the procedure, the physician will tell you what you will feel and when." Knowing she will get a heads-up might help her relax.
  - Briefly explain what she might experience. Tell her she might feel a warm, flushed sensation; a sudden burning feeling; or the need to urinate as the dye is injected. She will experience chest pain for a brief time during the insertion of the stent into the vessel. During or after the procedure, she might feel irregular heartbeats or temporary numbness and tingling of the extremity used for the procedure.
  - Reassure her that physicians and/or nurses will be with her at all times to assist her with pain control and give support and information as she requires it.
  - If you feel comfortable doing so, explore whether she would like someone to pray with her. This can be extremely powerful in relieving fear.

## CASE STUDY PROGRESS

The following day, you care for C.B. again. She is now on oral metoprolol, amiodarone, aspirin, and clopidogrel (Plavix). The norepinephrine and heparin have been discontinued. VS are stable.

9. Which laboratory test result should you check before beginning the clopidogrel therapy?
- PT/INR
  - aPTT
  - Platelet count
  - Potassium

Answer: c

Thrombocytopenia is a possible side effect of clopidogrel therapy; a baseline platelet count should be performed.

## CASE STUDY PROGRESS

As you work with C.B., you notice that she is extremely anxious. You had observed some anxiety yesterday, which you had attributed to the strange CCU environment, pain, and anticipation of the stenting procedure. The postprocedure test results showed that the stent was performing appropriately. You wonder what is wrong. She tells you that her heart attack occurred right in the middle of a move with her family from her rural community to an even smaller and unfamiliar town some 500 miles away in a neighboring state. She is dreading the move. Her husband "becomes angry easily and starts lashing out" toward her and the children. She is afraid to move to a community where she will have no friends and family to support her.

10. How can you help your patient? Evaluate the situation and describe possible interventions.
- The reasons for C.B.'s anxiety are much more complicated than you had thought. You need to decide whether you have the experience and background to help her or whether you should involve another member of the interdisciplinary team. Possible actions:
- Support the patient with your presence and active listening. Assure her that she is doing well physically.

- If spousal abuse is involved or suspected, a social worker or psychiatric nurse specialist who specializes in abuse would be an important resource.
- If child abuse is involved, you have an absolute ethical and, in most states, legal obligation to report the abuse to the authorities. C.B. should be given the number of a "safe house" or a community resource.
- It may be wise to obtain a medical order for a consultation about domestic violence.
- If her children are being abused, she should understand that this might involve child protective services.

#### CASE STUDY OUTCOME

C.B. agrees to speak with a social worker, and you set up the meeting before she is discharged. As a result, C.B. decides to postpone the move and stay with the children at her sister's home while she recuperates and seeks counseling at a women's support shelter. She tells you she will keep her appointment with the internist in 2 weeks.

