Stages of Atherosclerosis

**Chronic endothelial injury**
- Hypertension
- Tobacco use
- Hyperlipidemia
- Hyperhomocysteinemia
- Diabetes
- Infections
- Toxins

**A**

**Damaged endothelium**

**Fatty streak**
- Lipids accumulate and migrate into smooth muscle cells

**B**

**Fibrous plaque**
- Collagen covers the fatty streak
- Vessel lumen is narrowed
- Blood flow is reduced
- Fissures can develop

**C**

**Complicated lesion**
- Plaque rupture
- Thrombus formation
- Further narrowing or total occlusion of vessel

**D**
Vessel Occlusion With Collateral Circulation
Case Study

• M. P. is a 58-year-old white male who visits the local health clinic for a physical examination.
• He tells the health care provider that he occasionally gets “indigestion” when he mows the lawn.
• It goes away in 5-10 minutes after he stops and rests.
• *When obtaining a health history, what risk factors for coronary artery disease would you ask M.P. about?*
Two risk factors for coronary artery disease that increase the workload of the heart and increase myocardial oxygen demand are

a. Obesity and smokeless tobacco use.
b. Hypertension and cigarette smoking.
c. Elevated serum lipids and diabetes mellitus.
d. Physical inactivity and elevated homocysteine levels.
Which patient is most at risk for developing coronary artery disease?

a. A hypertensive patient who smokes cigarettes
b. An overweight patient who uses smokeless tobacco
c. A patient who has diabetes and uses methamphetamines
d. A sedentary patient who has elevated homocysteine levels
The nurse determines that teaching about implementing dietary changes to decrease the risk of CAD has been effective when the patient says,

a. “I should not eat any red meat such as beef, pork, or lamb.”

b. “I should have some type of fish at least 3 times a week.”

c. “Most of my fat intake should be from olive oil or the oils in nuts.”

d. “If I reduce the fat in my diet to about 5% of my calories, I will be much healthier.”
Collaborative and Nursing Management: CAD

- Lipid-lowering drug therapy
- Antiplatelet therapy
  - ASA
  - Clopidogrel (Plavix)
- Physical activity – modify for geriatrics
Case Study

M.P.’s health history and physical examination reveals the following risk factors for CAD:

- Family history of CAD
- Smokes 1 pack of cigarettes a day
- Sedentary lifestyle
- High fat diet
- BP 152/94
- BMI 30.2 kg/m²
Case Study

• Based on the presence of these risk factors and M.P.’s complaints of “indigestion” associated with activity, what type of angina is M.P. likely experiencing?

Table 34-9 Stable vs. Unstable
Clinical Manifestations of CAD

Angina

• O₂ demand > O₂ supply → myocardial ischemia

• Angina = reversible ischemia
  • Occurs when arteries are blocked 75% or more
  • Hypoxic within 10 seconds of occlusion
  • Viable for 20 minutes
Clinical Manifestations of CAD

Angina

• Lack of oxygen and glucose leads to anaerobic metabolism

• Lactic acid irritates nerve fibers → pain in cardiac nerves → Referred pain from transmission to the upper thoracic posterior nerve roots
Case Study

• While awaiting diagnostic testing for M.P., what drug would you expect the health care provider to prescribe for M.P. to use if he develops the “indigestion” pain the next time he mows the lawn?
Chronic Stable Angina

Q&A: Collaborative Care

• Short-acting nitrates
  • Dilate peripheral and coronary blood vessels
  • sublingually (tablet)/ spray
  • If no relief in 5 minutes, call EMS; repeat every 5 minutes max -3 doses

• Goal: ↓ O₂ demand and/or ↑ O₂ supply
Chronic Stable Angina
Q&A: Collaborative Care

• Long-acting nitrates
  • To reduce angina incidence
  • Main side effects: headache, orthostatic hypotension

• Methods of administration
  • Oral
  • Nitroglycerin (NTG) ointment
  • Transdermal controlled-release NTG
Chronic Stable Angina

Q&A: Collaborative Care

- Angiotensin-converting enzyme inhibitors (ACE)
- β-adrenergic blockers
- Calcium channel blockers
- Sodium current inhibitor
  - Ranolazine (Ranexa)
Case Study

- What diagnostic testing would you expect the health care provider to order for M.P.?
Chronic Stable Angina

Q&A: Collaborative Care

• Diagnostic studies
  • Chest x-ray
  • Laboratory studies
  • 12-lead ECG
  • Calcium-score screening heart scan
  • Echocardiogram
  • Exercise stress test
  • Pharmacologic nuclear imaging
Case Study

• M.P.’s chest x-ray and ECG results are all within normal limits.

• His cholesterol and triglyceride levels are also elevated.

• He develops chest pain and ST-segment depression during an exercise stress test.

• **What additional testing would you expect M.P. to undergo at this point?**
Chronic Stable Angina

Q&A: Nursing/Collaborative Management

• Cardiac catheterization/coronary angiography
  • Visualize blockages (diagnostic)
  • Open blockages (interventional)
    • Percutaneous coronary intervention (PCI)
    • Balloon angioplasty
    • Stent
Placement of a Coronary Artery Stent

A

B

C

Plaque
Pre-PCI and Post-PCI With Stent Placement

Case Study

• M.P. undergoes a cardiac catheterization.
• A 90% occlusion of his right coronary artery (RCA) is discovered.
• He has a balloon angioplasty and stent placement.
Case Study

• Discharge teaching related to CAD and necessary lifestyle changes (diet and exercise) is provided.

• He is scheduled for a follow-up with his health care provider.
Case Study

- 6 months later, MP arrives in the emergency department (ED)

- c/o severe, immobilizing chest pain radiating down his left arm.

- He admits to not following his health care provider’s advice related to diet and exercise.
Case Study

• He states that he thought the stent opened up his arteries and cured his CAD.

• The ED physician suspects ACS. 
  *Explain this diagnosis.*
Acute Coronary Syndrome

Coronary artery disease

Chronic stable angina

Acute coronary syndrome

- Unstable angina
- Non-ST-segment-elevation MI

ST-segment-elevation MI

Copyright © 2014 by Mosby, an imprint of Elsevier Inc.
• **Result**
  - Partial occlusion of coronary artery: UA or NSTEMI
  - Total occlusion of coronary artery: STEMI
Clinical Manifestations of ACS
Myocardial Infarction (MI)

• sustained ischemia (>20 minutes) ➔ irreversible myocardial cell death (necrosis)
• Subendocardium ➔ entire thickness of myocardium 4 to 6 hrs
• ➔ Loss of contractile function
Myocardial Infarction From Occlusion

Diagram of the heart showing:
- Circumflex coronary artery
- Right coronary artery
- Blockage
- Left anterior descending coronary artery
Acute Myocardial Infarction
Clinical Manifestations of ACS
Myocardial Infarction

• Pain
  • Atypical in women, elderly
  • No pain if cardiac neuropathy (diabetes)
Clinical Manifestations of ACS
Myocardial Infarction

• Catecholamine release – stimulation of SNS
  • Release of glycogen
  • Diaphoresis
  • Vasoconstriction of peripheral blood vessels
• Skin: ashen, clammy, and/or cool to touch
Clinical Manifestations of ACS
Myocardial Infarction

• Cardiovascular
  • Initially, ↑ HR and BP, then ↓ BP
    (secondary to ↓ in CO)
  • Crackles
  • Jugular venous distention
  • Abnormal heart sounds
    • S₃ or S₄
    • New murmur
Clinical Manifestations of ACS
Myocardial Infarction

- Nausea and vomiting
  - Reflex stimulation of the vomiting center by severe pain
  - Vasovagal reflex

- Fever
  - Up to 100.4° F (38° C) in first 24 hours
  - Systemic inflammatory process caused by myocardial cell death
Myocardial Infarction Healing Process

- Within 24 hours, leukocytes infiltrate the area of cell death

- Proteolytic enzymes of neutrophils and macrophages begin to remove necrotic tissue by fourth day → thin wall

- What necrotic zone changes on ECG will you see?
Myocardial Infarction Healing Process

- 10 to 14 days after MI, scar tissue is still weak
- Myocardium vulnerable to stress
- Monitor patient carefully as activity level increases
Myocardial Infarction Healing Process

- 6 weeks after MI,
  - scar tissue has replaced necrotic tissue

- Ventricular remodeling
  - hypertrophy and dilation
Complications of Myocardial Infarction

• Dysrhythmias
  • Most common complication
  • Present in 80% of MI patients
  • caused by ischemia, electrolyte imbalances, or SNS stimulation
  • Life-threatening (anterior MI, heart failure, or shock)
Complications of Myocardial Infarction

• Heart failure
  • Can be subtle or severe

• Cardiogenic shock
  • severe LV failure
  • aggressive management
Complications of Myocardial Infarction

- Papillary muscle dysfunction
  - mitral valve regurgitation
  - Aggravates an already compromised LV
    → rapid clinical deterioration

- Ventricular aneurysm
  - Myocardial wall becomes thinned and bulges out during contraction
  - Leads to HF, dysrhythmias, and angina
Complications of Myocardial Infarction

• Acute pericarditis
  • inflammation of visceral and/or parietal pericardium → cardiac tamponade, ↓ LV filling and emptying, heart failure

• Chest pain
• Pericardial friction rub
• ECG changes
• Tx: anti-inflammatory agents
Complications of Myocardial Infarction

- Dressler syndrome
  - Pericarditis with effusion & fever 4 to 6 weeks after MI
    - Pericardial (chest) pain
    - Pericardial friction rub
    - Pericardial effusion
    - Arthralgia

- Treated
  - short-term corticosteroids
Case Study

• Identify priority interventions for M.P. on his arrival at the ED.
Collaborative Care
Q&A: Acute Coronary Syndrome

• Initial interventions
  • 12-lead ECG *(pre-hospital -2015 AHA update)
  • Semi-fowler’s position
  • Oxygen
  • IV access
  • Nitroglycerin (SL)
  • ASA (chewable)
  • Morphine
Case Study

- M.P.’s ECG demonstrates significant ST elevation.

- What evidence-based intervention would you expect to prepare M.P. to undergo within 90 minutes of arrival to the ED?
Collaborative Care
Q&A: Acute Coronary Syndrome

• STEMI or NSTEMI with + cardiac markers $\rightarrow$ reperfusion therapy
• Emergent PCI
  • Gold standard
  • Goal: 90 minutes from door to balloon
  • Balloon angioplasty + drug-eluting stent(s)
Collaborative Care
Acute Coronary Syndrome

• Thrombolytic therapy

  • PCI not available
  • within 6 hours of onset
  • Criteria met within first hour
  • Given IV
  • Transfer to PCI 3-6 hours up to 24hrs post fibrinolysis (reperfusion updated* -AHA 2015)
Collaborative Care

Acute Coronary Syndrome

- Thrombolytic therapy
  - Draw blood and start 2–3 IV sites
  - Complete invasive procedures prior
  - Administer per protocol
  - Monitor closely for signs of bleeding
  - Assess for signs of reperfusion (return of ST segment to baseline best marker)

- IV heparin to prevent reocclusion
Collaborative Care

Acute Coronary Syndrome

• Coronary surgical revascularization
  • Failed medical management
  • Left main coronary artery or three-vessel disease
  • Not a candidate for PCI (e.g., lesions are long or difficult to access)
  • Failed PCI with ongoing chest pain
• Hx: DM
• long-term benefits
Collaborative Care

Acute Coronary Syndrome

• Coronary surgical revascularization
  • Coronary artery bypass graft (CABG) surgery
    • Requires sternotomy and cardiopulmonary bypass (CPB)
    • Uses arteries and veins for grafts
  • Minimally invasive direct coronary artery bypass (MIDCAB)
    • Alternative to traditional CABG
Cardiopulmonary Bypass


Copyright © 2014 by Mosby, an imprint of Elsevier Inc.
Internal Mammary Artery and Saphenous Vein Grafts

- Left subclavian artery
- Left internal mammary artery
- Ascending aorta
- Saphenous vein graft to right coronary artery
- Blockage

Copyright © 2014 by Mosby, an imprint of Elsevier Inc.
Radial Artery Graft

- Thick muscular artery prone to spasm.

- Perioperative Tx:
  - calcium channel blockers
  - long-acting nitrates

- Patency rates:
  - 5 years are as high as 84%.
Collaborative Care

Acute Coronary Syndrome

• Coronary surgical revascularization
  • Off-pump coronary artery bypass
    • Sternotomy but no CPB
  • Robot-assisted surgery
  • Transmyocardial laser revascularization
    • Indirect revascularization
    • High-energy laser creates channels in heart to allow blood flow
Collaborative Care

Acute Coronary Syndrome

• Drug therapy

  • IV nitroglycerin
  • Morphine sulfate
  • β-adrenergic blockers
  • Angiotensin-converting enzyme inhibitors
  • Antidysrhythmia drugs
  • Cholesterol-lowering drugs
  • Stool softeners
A patient is admitted to the coronary care unit following a cardiac arrest and successful cardiopulmonary resuscitation. When reviewing the health care provider’s admission orders, which order should the nurse question?

a. Oxygen at 4 L/min per nasal cannula
b. Morphine sulfate 2 mg IV every 10 minutes until the pain is relieved
c. Tissue plasminogen activator (t-PA) 100 mg IV infused over 3 hours
d. IV nitroglycerin at 5 mcg/minute and increase 5 mcg/minute every 3 to 5 minutes
Case Study

- M.P. undergoes emergent PCI with additional stent placement, this time to his circumflex artery.
- He is admitted to the coronary critical care unit.
- *Identify appropriate nursing diagnoses for M.P.*
Nursing Management
Q&A:
Chronic Stable Angina and ACS

• Nursing diagnoses
  • Decreased cardiac output
  • Acute pain
  • Anxiety
  • Activity intolerance
  • Ineffective self-health management
Case Study

- Describe appropriate nursing care of M.P. following his PCI.
Nursing Management

Q&A: Acute Coronary Syndrome

• Coronary revascularization: PCI
  
  • Monitor for recurrent chest pain
  • VS q15minx3, q30minx2, q1x4 cardiac rhythm
  • Monitor insertion site for bleeding
  • Neurovascular assessment
  • BR/ procedure standards or hospital policy
Nursing Management
Acute Coronary Syndrome

• Coronary revascularization: CABG
  
  • ICU for first 24–36 hours
  • Pulmonary artery catheter
  • Intraarterial line
  • Pleural/mediastinal chest tubes
  • Continuous ECG
  • ET tube with mechanical ventilation
  • Epicardial pacing wires
  • Urinary catheter
  • NG tube
Nursing Management
Acute Coronary Syndrome

• Complications related to CPB
  • Bleeding and anemia
  • Fluid and electrolyte imbalances
  • Hypothermia
  • Infections
Nursing Management
Acute Coronary Syndrome

• CABG: postoperative nursing care
  • Assess patient for bleeding
  • Monitor hemodynamic status
  • Assess fluid status
  • Replace electrolytes PRN
  • Restore temperature
  • Monitor for atrial fibrillation (*common)
Nursing Management
Acute Coronary Syndrome

• CABG: postoperative nursing care
  • Surgical site care
    • Radial artery harvest site
    • Leg incisions
    • Chest incision
  • Pain management
  • DVT prevention
  • Pulmonary hygiene
  • Cognitive dysfunction
Nursing Management
Acute Coronary Syndrome

• Ambulatory and home care
  • Cardiac rehabilitation
  • Patient and caregiver teaching
  • Physical activity
Case Study

• When discussing activity restrictions and expectations after discharge with M.P., he assumes his sex life is now over as he does not want to die having sex with his wife.

• *How will you respond?*
Nursing Management
Q&A: Acute Coronary Syndrome

• Ambulatory and home care:
  • Resumptions of sexual activity
    • Discuss as physical activity
    • Erectile dysfunction drugs contraindicated
      with nitrates
    • Prophylactic nitrates before sexual activity
    • When to avoid sex
    • Typically 7–10 days post MI or when patient
      can climb two flights of stairs

Copyright © 2014 by Mosby, an imprint of Elsevier Inc.
Sudden Cardiac Death
Nursing/Collaborative Management

• Abrupt disruption in cardiac function, resulting in loss of CO & cerebral blood flow

caused by:
  • ventricular dysrhythmias
  • Structural heart disease
  • Conduction disturbances
Sudden Cardiac Death
Nursing/Collaborative Management

• Diagnostic workup
  • Cardiac markers
  • ECGs
• Cardiac catheterization
• PCI or CABG
• 24-hour Holter monitoring
• Exercise stress testing
• Signal-averaged ECG
• Electrophysiologic study (EPS)

TX:
• Implantable cardioverter-defibrillator (ICD)
• Antidysrhythmic drugs
Sudden Cardiac Death
Nursing/Collaborative Management

• Patient teaching
• Psychosocial adaptation
  • “Brush with death”
  • “Time bomb” mentality
• Additional issues
  • Driving restrictions
  • Role reversal
  • Change in occupation
The most significant factor in long-term survival of a patient with sudden cardiac death is

a. Absence of underlying heart disease.
b. Rapid institution of emergency services and procedures.
c. Performance of perfect technique in resuscitation procedures.
d. Maintenance of 50% of normal cardiac output during resuscitation efforts.
The nurse is caring for a patient who survived a sudden cardiac death. What should the nurse include in the discharge instructions?

a. “Because you responded well to CPR, you will not need an implanted defibrillator.”

b. “Your family members should learn how to perform CPR and practice these skills regularly.”

c. “The most common way to prevent another arrest is to take your prescribed drugs.”

d. “Since there was no evidence of a heart attack, you do not need to worry about another episode.”