Objectives

- Understand acute coronary syndromes and how to recognize clinical manifestation.
- Understand clinical diagnostics related to acute coronary syndrome
- Understand nursing action and responsibility in caring for patients with acute coronary syndrome

Acute Coronary Syndromes

- Atherosclerosis
  - Progressive disease affecting arteries
- Coronary artery disease (CAD)
  - Atherosclerotic changes from atherosclerosis
  - Biggest contributor to cardiovascular morbidity and mortality
- Coronary heart disease (CHD)
  - Disease process of atherosclerosis and coronary artery disease
  - Other heart structures become involved
Acute Coronary Syndromes

- Any vascular disorder that narrows or occludes the coronary arteries
- Atherosclerosis is the most common cause
- Modifiable Risk factors
  - Dyslipidemia
  - Hypertension
  - Cigarette smoking
  - Diabetes mellitus
  - Obesity/sedentary lifestyle

Non Modifiable Risk Factors
- Age
- Gender
- Family history
- Race

Coronary Artery Disease – Ischemic Heart Disease Pathophysiology

- This is most commonly due to obstruction of the epicardial (on the surface) coronary arteries due to atherosclerosis
- Atherosclerotic plaque narrows lumen of artery
  - Affects medium-size arteries
  - Chronic inflammatory disorder
- Atherosclerotic plaque rupture
  - Rapidly forming coronary thrombosis
- Plaque regression is possible with change in risk factors

Acute Coronary Syndromes

Lack of oxygen causes myocardial ischemia, which manifests as chest pain

- Transient ischemia
- Unstable angina
- Sustained ischemia
- Myocardial infarction
- Myocardial inflammation and necrosis

- Myocardial ischemia
  - Local, temporary deprivation of the coronary blood supply
  - Stable angina
  - Prinzmetal angina
  - Silent ischemia
  - Angina pectoris
Acute Coronary Syndromes

- Stable angina:
  - Chest discomfort that occurs predictably and reproducibly at a certain level of exertion
  - AND
  - is relieved with rest or nitroglycerin

- Unstable angina:
  - Plaque formation with rupture and platelet activation
  - Glycoprotein IIb/IIIa inhibitors
  - Treat
    - beta blockers to decrease O2 consumption
    - Ca channel blockers to decrease after load an O2 consumption

Women and Coronary Heart Disease

Most common cause of death and disability in women in the United States

A higher proportion of silent Q wave infarctions in older women was noted in a report from the HERS trial

Acute Coronary Syndromes (ACS)

- STEMI vs. Non-STEMI vs. Unstable angina

<table>
<thead>
<tr>
<th>Symptoms 1 Month before Acute MI</th>
<th>Symptoms during Acute MI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unusual fatigue (71%)</td>
<td>Shortness of breath (56%)</td>
</tr>
<tr>
<td>Sleep disturbance (48%)</td>
<td>Weakness (55%)</td>
</tr>
<tr>
<td>Shortness of breath (42%)</td>
<td>Unusual fatigue (43%)</td>
</tr>
<tr>
<td>Irritation (39%)</td>
<td>Cold sweat (39%)</td>
</tr>
<tr>
<td>Anxiety (36%)</td>
<td>Diaphoresis (36%)</td>
</tr>
<tr>
<td>Heart racing (27%)</td>
<td>Nausea (36%)</td>
</tr>
<tr>
<td>Arms weak/heavy (25%)</td>
<td>Arms heaviness or weakness(55%)</td>
</tr>
<tr>
<td>Changes in thinking or memory (24%)</td>
<td></td>
</tr>
<tr>
<td>Vision change (23%)</td>
<td>Ache in arms (32%)</td>
</tr>
<tr>
<td>Loss of appetite (22%)</td>
<td>Heat or flushing (38%)</td>
</tr>
<tr>
<td>Hands or arms tingling (22%)</td>
<td>Indigestion (31%)</td>
</tr>
<tr>
<td>Difficulty breathing at night (16%)</td>
<td>Pain centered high in chest (31%)</td>
</tr>
<tr>
<td></td>
<td>Heart racing (23%)</td>
</tr>
</tbody>
</table>

Emergency Response

Nursing Management

- Recognize symptoms as cardiac related
- Relieve chest pain
- Recognition of complications
- Maintain a calm environment
- Provide patient and family education

Initial Assessment

- Establish **Airway, Breathing, and Circulation**
  - Obtain preliminary history if able
- Cardiac monitor attached to patient
- Code Cart brought to the bedside
- Give Oxygen at 4L as ordered
- IV access and obtain blood work (**cardiac marker enzymes**, lyes, coags, serum lipids, renal function) as ordered
- Aspirin 162 to 325 mg given as ordered
- Nitrates and morphine given as ordered (may be contraindicated)
- 12-lead ECG interpreted, repeat every 20-30 minutes
Diagnostic Cardiac Biomarkers

<table>
<thead>
<tr>
<th>Serum Biomarker</th>
<th>Time to Initial Elevation</th>
<th>Peak Elevation</th>
<th>Return to Baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creatine Kinase-Muscle/Brain (CK-MB) - non specific</td>
<td>4-8 hours after MI</td>
<td>15-24 hrs</td>
<td>2-3 days</td>
</tr>
<tr>
<td>Troponin – specific to cardiac muscle</td>
<td>3-6 hours after MI</td>
<td>24 hrs</td>
<td>5-10 days</td>
</tr>
<tr>
<td>Myoglobin</td>
<td>1-4 hours after MI</td>
<td>8-12 hrs</td>
<td>24 days</td>
</tr>
</tbody>
</table>

If patient comes to ED 2 hours after chest pain begins, will cardiac biomarkers be elevated?

- Echocardiogram to determine wall movement
- 12-lead ECG to identify changes in ST segment

Determine Management Based on Diagnostic Findings

- **GOAL:** Recanalization (opening) of the coronary artery – Options are:
  - Fibrinolytic Therapy with tPA
  - Percutaneous Coronary Intervention (PCI)
- **Prevent further damage**
  - Anticoagulation – heparin gtt
  - Dysrhythmia preventions
    - Beta blockers
  - Tight glucose control
  - Prevent ventricular remodeling
    - Angiotensin-converting enzyme inhibitors

Antianginal - Nitrates

- **Original medications used to control angina**
- **Mechanism of Action**
  - Affect vascular smooth muscle causing dilation in peripheral arteries, veins and coronary arteries
  - Dilation allows an increased more blood in the veins thereby reducing volume to heart (reduced preload)
  - Decreases workload of the heart
  - Coronary artery dilation increase blood flow and oxygen supply to myocardium
- **Beta Adrenergic Blockers** to slow the heart rate, reduce workload and decrease overall oxygen demand
- **Calcium Channel Blockers** to provide vasodilation, depress cardiac contractility, heart rate and conduction
Nitrates

- Relaxes smooth muscle layer of the blood vessels, which allows for dilation of the vessel and improved blood flow
- Decreases preload, afterload, and myocardial O2 consumption
- Assessment: chest pain, vitals, headache, dizziness, vertigo
- Examples:
  - Nitrates: Nitroglycerin, Isordil (isosorbide), Nitro-Bid, Imdur

Nitrates

- Rapid Acting
  - SL or spray to avoid hepatic first pass which would render it ineffective
  - Relieves symptoms of angina within 1-5 minutes
  - May cause burning under tongue
  - Open bottle expires within one year (mark date)
  - Oral nitrates should be taken on empty stomach 1 hour before or 2 hours after meal
- Long Acting
  - Maintains vasodilation and decrease cardiac workload
  - Transdermal ointment

Anticoagulant

- Used to prevent the formation and extension of a thrombus
  - Used in A-Fib
  - Prevention of deep vein thrombus
  - Post MI to prevent embolization
Anticoagulants, cont.

- **Coumadin**
  - Used for long term therapy for DVT’s and A-Fib, PE, post MI, post valve replacement
  - Monitor PT and INR
  - Watch for drug interactions (ASA, NSAIDS, beta blockers)

- **Heparin**
  - Used for acute therapy – PE, venous thrombosis, A-Fib, some stroke patients, coronary occlusion
  - Monitor PTT
  - Watch for drug interactions
  - Protamine sulfate on hand

- **Low molecular weight heparin**
  - Fragmin, Lovenox, Arixtra
  - Usually not followed with lab work as closely as the others
Thrombolytic Drugs

- Used to dissolve blood clots and reopen blood vessels
- Must be watched closely for bleeding
- EX: Activase (TPA), Retrovase, Betapace, Streptokinase
  - More effective if used in the 1st 6 hours after an MI
  - Can be given IV or directly into the coronary arteries
  - Works on fibrin in the clotting mechanism
- ReoPro
  - Works on the platelet component
  - May be given IV during a PTCA may be used in conjunction with TPA
  - Used with heparin and ASA with unstable angina or MI
- Monitor
  - PT/PTT, Hgb/Hct, CPK
  - ECG monitoring
  - Watch for bleeding

Antiplatelet Agents

- Decrease platelet aggregation and inhibit thrombus formation
- Used after an MI or stroke
  - ASA
  - Plavix
  - Persantine – vasodilator also, use with warfarin in patients with valvular disease
  - Ticlid
  - ReoPro – Cath lab only
- Monitor
  - CBC, LFT’s
  - Watch for bleeding!

Nursing Management

- Nursing priorities include:
  - Balance myocardial oxygen supply and demand
    - Medications
      - ACE Inhibitor, ARB, Statin, ASA, Beta Blocker
    - Mobility – manage O2 demand by limiting mobility
      - Bedrest with bedpan / bedside commode
  - Preventing complications
    - Dysrhythmias – monitor ST segment for changes
    - Chest Pain – morphine
Dysrhythmias

- Range from occasional “missed” or rapid beats to severe disturbances that affect the pumping ability of the heart
- Can be caused by an abnormal rate of impulse generation or abnormal impulse conduction
- Examples:
  - Tachycardia, flutter, fibrillation, bradycardia, premature ventricular contractions (PVCs), premature atrial contractions (PACs), asystole

Myocardial Infarction Complications

- Ventricular septal defect
  - Abnormal communication between right and left ventricles
  - May be present since birth (most common)
  - Rare complication of anterior wall MI
- Papillary muscle rupture
- Cardiac wall rupture
- Pericarditis
- Heart failure

Myocardial Infarction Complications

- Ventricular aneurysm
  - Noncontractile thinned left ventricular wall
  - Most often occurs with acute left anterior descending (LAD) artery occlusion
- Complications of aneurysm
  - Heart failure
  - Systemic emboli
  - Angina
  - Ventricular tachycardia
Test Your Knowledge

• The primary goal of thrombolytic therapy for ACS is
  – Troponin release in response to myocardial damage
  – Chest pain relief
  – Myocardial reperfusion to establish and maintain coronary patency
  – Ectopy prevention which is common with coronary artery reperfusion

Test Your Knowledge

• Your patient develops chest pain, SOB and coughing 3 days after STEMI. What should you suspect?
  – Pneumothorax
  – Aortic dissection
  – Pulmonary embolism
  – pericarditis

Cardiogenic Shock
Cardiogenic Shock

- Results of failure of the heart to effectively pump blood forward.
  - Occurs with dysfunctional ventricular ischemia, structural problems and dysrhythmias
  - Most common is MI with loss of >40% of functional myocardium.
  - May occur after one massive MI or several smaller ones.

CARDIOGENIC SHOCK

- “Pump failure”
- Severe left sided heart failure most die within 24"

VICIOUS CYCLE

LOW CARDIAC OUTPUT

EVEN LOWER CARDIAC OUTPUT

MYOCARDIAL ISCHEMIA

SYMPATHETIC COMPENSATION

Cardiogenic Shock - Signs & Symptoms

Unable to maintain adequate cardiac output

Signs of Low cardiac output

- Cool clammy extremities
- Poor capillary refill
- Tachycardia
- Narrow pulse pressure
- BP < 80 systolic
- Low urine output
- Rapid, Shallow respirations
- Cyanosis
- Confusion/Restlessness
Cardiogenic Shock - Assessment

- Hypotension
- Cardiac Enzymes, Troponin Elevated
- 12 lead ECG shows Acute MI
- Echocardiogram shows
  - Ventricular dysfunction
  - Aneurysm
  - Ventricular Septal Defects

Medical Management

- Goals
  - Treat underlying cause of pump failure
    - Revascularization or CABG, thrombolytics or VAD
  - Enhance the effectiveness of the pump
    - IABP, inotropic medication, vasopressors, diuretics, vasodilators after blood pressure is stabilized and dysrhythmia control.
  - Improve tissue perfusion
    - Mechanical ventilation

Cardiogenic Shock - Treatment

- Goals:
  - Increase and maintain blood pressure using vasopressors
  - Increase cardiac contractility with positive inotropes
  - Reducing preload with diuretics
  - After blood pressure is stabilized, may use vasodilating agents for preload and afterload reduction
  - Antidysrhythmias to control dysrhythmias that may decrease cardiac output
  - Rest the heart using IABP or if too much damage, may need ventricular assist device
Nursing Management

• Prevention of cardiogenic shock
  – Identify patients at risk, facilitate early reperfusion therapy and frequent assessments
• Limit myocardial oxygen consumption and enhance oxygen supply
  – Limit activities if drop in O₂ Sat occurs, monitor RR and status, cardiac dysrhythmias

CARDIOVASCULAR THERAPEUTIC MANAGEMENT

Catheter-Based Interventions

• Atherectomy
  – Directional atherectomy
  – Rotablator
  – Transluminal extraction catheter
  – Excision and removal of atherosclerotic plaque by cutting, shaving, or grinding
    • Directional atherectomy (DCA)
    • Rotational ablation catheter (Rotablator)
Fibrinolytic Therapy

• Goal: Lysis of the acute thrombus, opening the obstructed coronary artery and restoring blood flow

• Inclusion criteria
  - 12 hours or less after onset of chest pain
  - Persistent ST elevation on ECG
  - Bundle branch block with a history suggestive of AMI
  - Ischemic chest pain of 30 minutes' duration
  - Chest pain unresponsive to sublingual nitroglycerin

• Exclusion criteria
  - Patients who have stable clots from recent surgery, trauma, or stroke

Fibrinolytic Agents

• Clot specific
  - t-PA (alteplase)
  - r-PA (reteplase)
  - TNKase (tenecteplase)

• Non–clot specific
  - SK (streptokinase)
  - APSAC (anistreplase)
Percutaneous Coronary Interventions (PCI)

• Indications
  – CAD: single- or multi-vessel
  – Previous saphenous and internal mammary grafts
  – Failed fibrinolytic therapy
  – Preferred initial method of treatment for MI

• Surgical backup less often required
  – Availability of cardiac surgical services on site still recommended

• Percutaneous coronary intervention (PCI)
  – Percutaneous transluminal coronary angioplasty (PTCA)
  – Atherectomy
  – Stent implantation

Percutaneous Transluminal Coronary Angioplasty (PTCA)

• Use of balloon-tipped catheter to dilate the stenotic area
• Balloon pressure stretches the vessel wall, fractures the plaque, and enlarges the vessel

• Limitations
  – Risk of acute vessel closure
  – High frequency of restenosis

Coronary stents

• Subacute stent thrombosis
  – Goal is prevention
  – Dual antiplatelet therapy
  – IV antiplatelet agents

• In-stent restenosis
  – Increased incidence with bare metal stents

• Polymer coating impregnated with drugs
• Released slowly into endothelium at site of stent placement to inhibit cellular proliferation
Catheter-Based Interventions

• Coronary stents
  – Metal structure introduced into the coronary artery and expanded into the vessel wall at site of lesion
  • Bare metal stents

Evidence of Reperfusion

• Invasive evidence
  – Can be directly observed under fluoroscopy in the cardiac catheterization laboratory

• Noninvasive evidence
  – Cessation of chest pain
  – Reperfusion dysrhythmias, primarily ventricular rhythms
  – Elevated ST segments return to baseline
  – Early and marked peaking of creatine kinase
Acute complications after PCI

- Coronary spasm
- Coronary artery dissection
- Coronary thrombosis
- Bleeding and hematoma formation at site of vascular cannulation
- Compromised blood flow to extremity
- Retroperitoneal bleeding
- Contrast-induced renal failure
- Dysrhythmias
- Vasovagal response

Nursing Management

- Nursing priorities for patients after PCI are directed to:
  - Monitoring for recurrent angina
  - Managing the femoral or radial access site
  - Assessing for bleeding
  - Assisting with ambulation
  - Providing patient education

Nursing management

- Assessment of patient condition for clinical manifestations of potential problems
- Prevent/minimize complications of catheter procedures
  - Angina
  - Renal protection
  - Femoral site care: vascular closure systems
- Patient and family education
Discharge Planning

• Patient education
  – Medication
    • ACE Inhibitor, ARB, Statin, ASA, Beta Blocker
  – Diet
  – Activity

Cardiac Surgery

• CABG has superior long-term patency rated, surpassing those of angioplasty and stents
• Anticipated length of stay is 5-9 days
**Types of grafts**

- **Saphenous vein graft**
  - Excised portion of the saphenous vein proximal to the aorta

- **Internal mammary artery**
  - Remains attached to its origin subclavian artery
  - Offers long term patency

- **Radial artery or gastroepiploic artery**
  - Patency rates are not as good as others

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**VALVULAR HEART DISEASE**

**Assessment of Cardiac Valves**

$S_1$ and $S_2$ are normal heart sounds

- **$S_1$** = closure of mitral ($M_1$) and tricuspid ($T_1$) valves at ventricular contraction (louder)
  - $M_1$ heard best at 5th intercostal space at MCL
  - $T_1$ heard best at 4th ICS at left sternal border
  - Occurs immediately after the QRS complex

- **$S_2$** = closure of aortic ($A_2$) and pulmonic ($P_2$) valves
  - $A_2$ is best heard at 2nd ICS, right of sternum
  - $P_2$ is best heard 2nd ICS, left of sternum
  - Occurs during diastole, during the T wave or slightly before QRS
Four Common Abnormal Situations for Abnormal Heart Sounds

Valvular Regurgitation – (insufficiency) = blood flows past closed valve
  – Mitral/Tricuspid = murmur during systole
  – Aortic/pulm = murmur during diastole

Valvular Stenosis (stiff) = resistance to pushing blood through open valve
  – Mitral/Tricuspid = murmur during diastole
  – Aortic/pulm = murmur during systole
Four Common Abnormal Situations for Abnormal Heart Sounds

- Disturbances of electrical conduction — bundle branch block that creates a split in the heart sound
  - RBB = delay in RV contraction — pulm valve closes slightly after aortic valve
  - $S_2$ becomes softer and produces two sounds

- Ventricular or Atrial Failure
  - increased pressure in atria / ventricles = increased flow of blood causes $S_3$ = gallop or $S_4$ = high atrial pressure
  - $S_2 > S_3 = S_1$ = gallop
  - Not always abnormal but significant with tachycardia
  - Occurs with LV (cong) HF
  - $S_2 > S_1 > S_3 = TEN$ a see

Causes of Valvular Dysfunction

- Rheumatic fever
- Infective endocarditis
- Degenerative changes in tissue
- Trauma
- Papillary muscle rupture from MI
- Systemic diseases

Mitral Valve Dysfunction

Mitral Valve Regurgitation

Signs and Symptoms

- Dyspnea
- Orthopnea
- Paroxysmal nocturnal dyspnea
- Pulmonary hypertension
- Decreased cardiac output
- Crackles
- Holosystolic murmur at apex
- S3
- Atrial fibrillation
- Signs of right heart failure
- Valve repair needed
Mitral Valve Stenosis

**Signs and Symptoms**
- Due to rheumatic fever
- Symptoms due to size of opening decreasing
- Dyspnea on exertion
- Progressive fatigue
- Cough
- Hemoptysis
- Right heart failure
- Elevated RV pressure
- Atrial fibrillation
- Valve repair needed

Tricuspid Valve Regurgitation (Insufficiency)

**Signs & Symptoms**
- “Honking” that becomes louder with inspiration
  - Watch for afib
  - Fluttering in neck
  - Shortness of breath
  - Swelling in legs, abd pain
- Caused by
  - Infection (rheumatic fever or infective endocarditis)
  - Dilated right ventricle
  - Increased pressure from lung (PAH)

Tricuspid Valve Stenosis

**Caused by**
- Infection (rheumatic fever)

**Signs & Symptoms**
- Enlarged right atrium leading to smaller right ventricle – less blood to lungs and tissues
- Fluttering in neck
- Shortness of breath

**Rarely requires surgical intervention**
Aortic Valve Regurgitation

Aortic Valve Regurgitation

Aortic Valve Stenosis

Aortic Valve Stenosis

Valvular Surgery

- Aortic Valve –
  - Replacement, some repairs done only for some regurgant valves

- Mitral Valve
  - Commissurotomy – mitral stenosis, fuses leaflets are excised and Ca++ deposits debrided
  - Valve Repair – mitral regurgitation, uses a ring to reduce the size of the dilated mitral valve opening
    - Preferred over replacement to avoid complications
  - Valve Replacement – complicated with risk of thromboembolic events and long term anticoagulation

- Signs and Symptoms
  - LV overload causing dilation and hypertrophy of LV
  - Fatigue
  - Dyspnea
  - Paroxysmal nocturnal dyspnea
  - Orthopnea
  - Angina
  - Widened pulse pressure
  - S3
  - Systolic murmur heard over aortic and Erb’s point
  - Sinus tachy
  - s/s of heart failure, HTN, dysrhythmias
  - Valve repair needed

- Signs and Symptoms
  - Causes and obstruction in LV to the systemic circulation during systole
  - Syncope
  - Fatigue
  - Palpitations
  - Angina
  - As valve narrows, s/s of L HF develop
  - Surgical repair needed
Types of Valves

- **Mechanical valves**
  - Caged-ball valve
  - Tilting-disk valve
  - Bi-leaflet valve

- **Biologic (tissue) valves**
  - Porcine (aortic valve) heterograft
  - Homograft

### Bioprosthetic / Tissue Valves
- Carpenter-Edwards Bovine
- Porcine
- Hancock Pericardial valves
  - Short term coumadin requirements
  - Limited longevity (10-15 years)
  - Specific patient populations

### Mechanical Valves
- St. Jude or ATS (Advancing the Standard)
  - Coumadin for life
  - Longevity-lasts a lifetime

Nursing Management

- Nursing priorities for patients with valvular heart disease are focused on:
  - Maintaining adequate cardiac output.
  - Optimizing fluid balance.
  - Providing patient education.
Nursing Management 48 hours Post-Op

- Major Goal is prevention of thrombus formation!!
- Hemodynamic stability
  - Hypovolemic
  - Hemorrhage
- Dysrhythmias
  - Atrial fibrillation – common at day 2-3
  - Ventricular arrhythmias – most common in early postop period
  - Factors that lead to arrhythmias include acidosis, manipulation of the heart and myocardial ischemia
- Hypothermia
- Electrolyte disturbance (especially hypokalemia and hypomagnesaemia)
- Pericardial effusion/tamponade

Emergency Care of Cardiac Tamponade

- Cardiac tamponade—an extreme emergency
  - Watch for elevated CVP, decreased cardiac output and blood pressure, jugular vein distention, muffled heart sounds, sudden cessation of chest tube drainage.
  - Call code blue and inform team of findings
  - Expect emergency sternotomy or return to OR to remove clot and fluid.

Test Your Knowledge

- Your patient with acute coronary syndrome who has undergone cardiac surgery 2 days ago develops new onset JVD, muffled heart tones, palpitations, difficulty breathing and chest pain that worsens with coughing. You notice decreases peripheral pulses.
  - Vital Signs
    - 3 hours ago
      - BP 110/60
      - HR 96
      - RR 20
    - Current
      - BP 90/50
      - HR 134
      - RR 28
  - What is happening?
  - What should you anticipate?
Test Your Knowledge

• Which of the following isoenzymes is most diagnostic of identifying MI?
  – Troponin I
  – CPK-MB
  – CPK-BB
  – Troponin K