

# Chapter 21

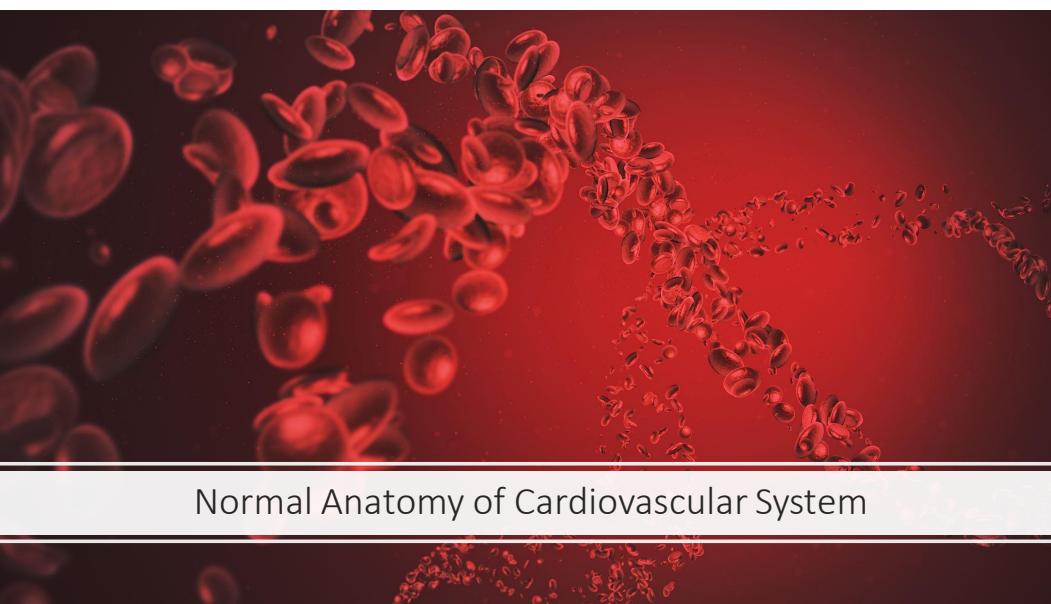
## Cardiovascular System Function, and Therapeutic Measures

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Health and Illness III



## Chapter 21 Objectives

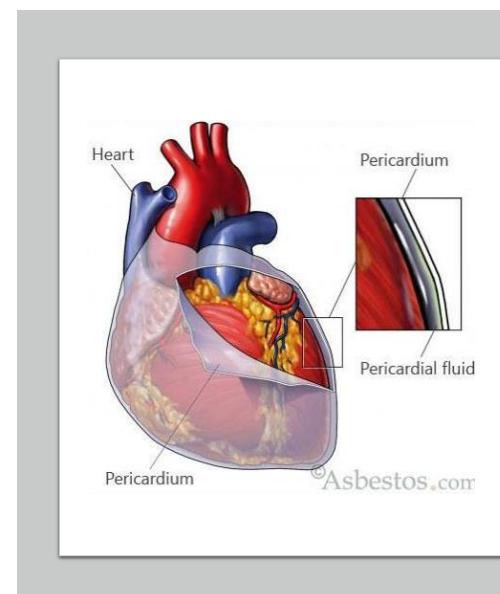
- Identify the normal anatomy of the cardiovascular system
- Explain the normal function of the cardiovascular system
- List data to collect when caring for a patient with a disorder of the cardiovascular system
- Identify diagnostic tests commonly performed to diagnose disorders of the cardiovascular system
- Plan nursing care for patients undergoing diagnostic tests for cardiovascular disorders
- Describe current therapeutic measures for disorders of the cardiovascular system
- Describe preoperative and postoperative care for patients undergoing cardiac surgery



Normal Anatomy of Cardiovascular System

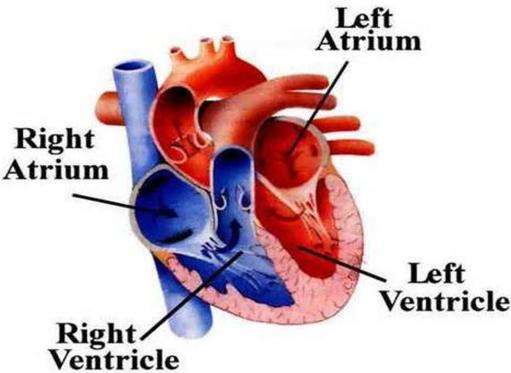
## Location of the Heart

- Mediastinum within thoracic cavity
- **Enclosed by 3 membranes**
  - Outermost-fibrous pericardium
  - Middle-parietal pericardium
  - Innermost-Visceral Pericardium (Epicardium)
- **Between membranes is serous fluid**
  - Prevents friction when heartbeats



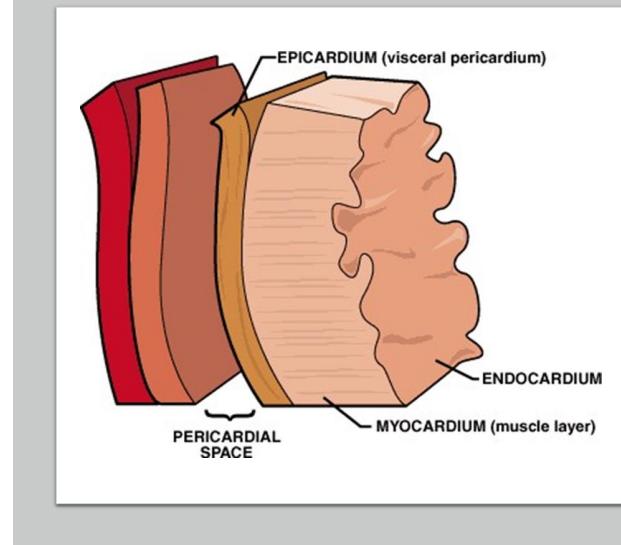
## Structure of Heart

- Four Chambers:
- Right Atrium
- Right Ventricle
- Left Atrium
- Left Ventricle



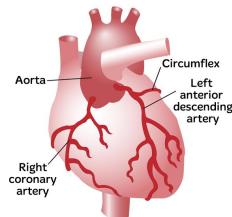
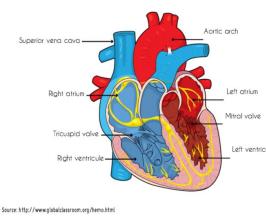
## Cardiac Layers

- Epicardium-Visceral layer
  - Fibrous sack encloses heart
- Myocardium- Muscle layer
- Endocardium-Inner layer
  - Forms barrier to prevent blood from being absorbed
  - Folds back on itself to form the heart valves.



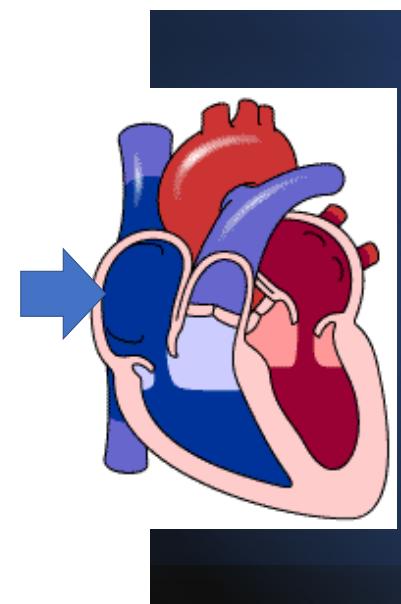
## Structure of Coronary Blood Vessels

- Superior and Inferior Vena Cava
  - Return deoxygenated blood from the body back to the heart
- Aorta
  - Takes oxygenated blood to the body
- Coronary Arteries and Veins
  - Supply blood to and from the heart



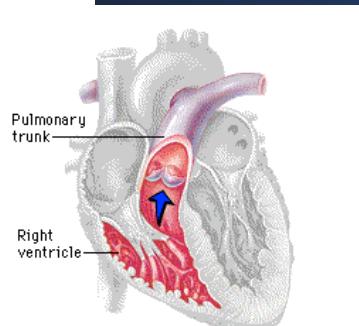
## Coronary Blood Flow- Right Atrium

- Receives deoxygenated blood from vena cava.
- Blood is dark- Decreased oxygen saturation of red blood cells



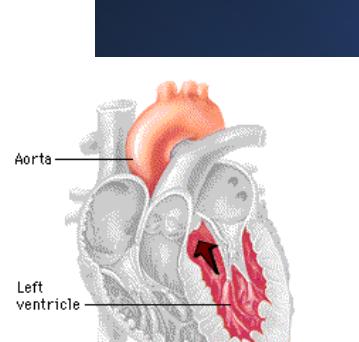
## Coronary Blood Flow- Right Ventricle

- **Receives blood from** right atrium.
- **Contracts & pushes** blood to lungs



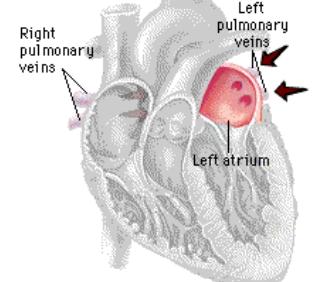
## Coronary Blood Flow- Left Ventricle

- **Receives oxygenated blood** from left atrium
- **Contracts & pushes** blood out through aorta to body



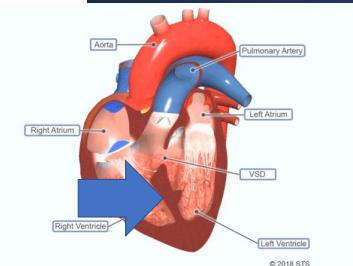
## Coronary Blood Flow- Left Atrium

- **Receives oxygenated blood** from lungs
- Blood is **brighter**- red blood cells have been **re-oxygenated**



## Coronary Blood Flow- Septum

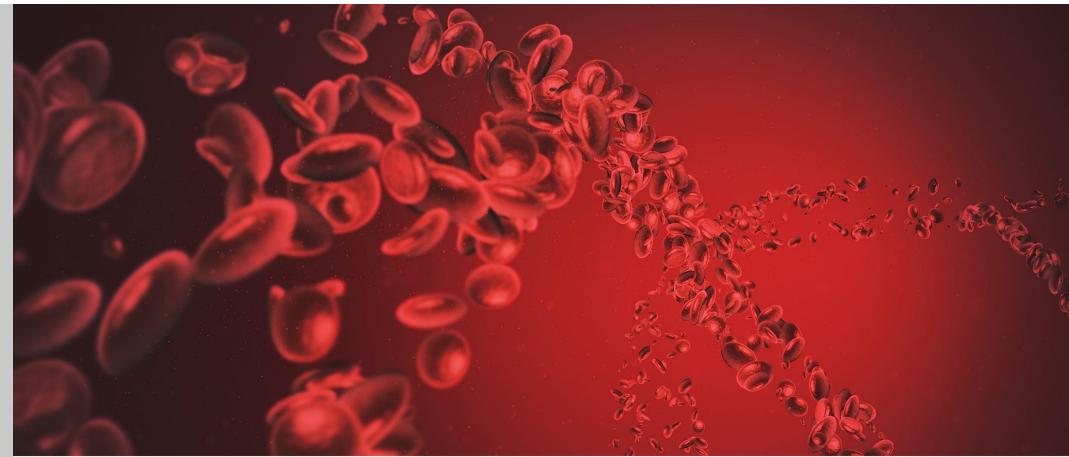
- **Separates the**
  - Right and left atria
  - Left and right ventricles



# Mr. W's Circulatory System Rap



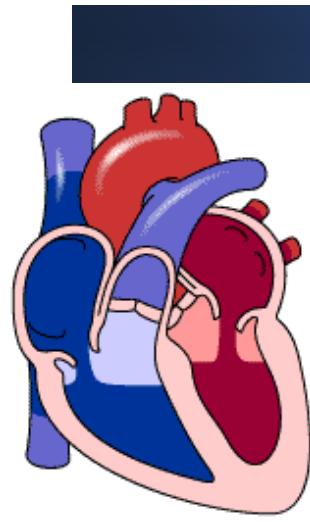
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Normal Function of Cardiovascular System

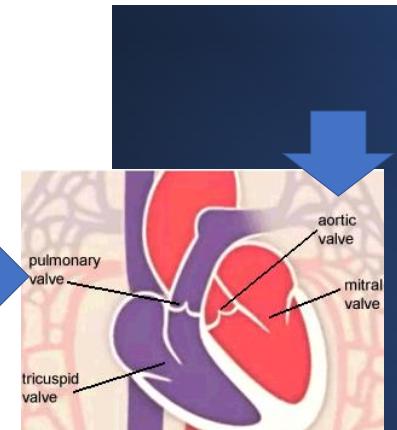
## Types & Function-Valves

- **Prevents backflow of blood**
- **Seals off the entry & exit of ventricles**
- Open and closes based on pressure



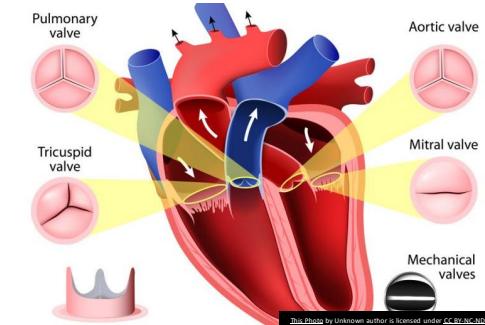
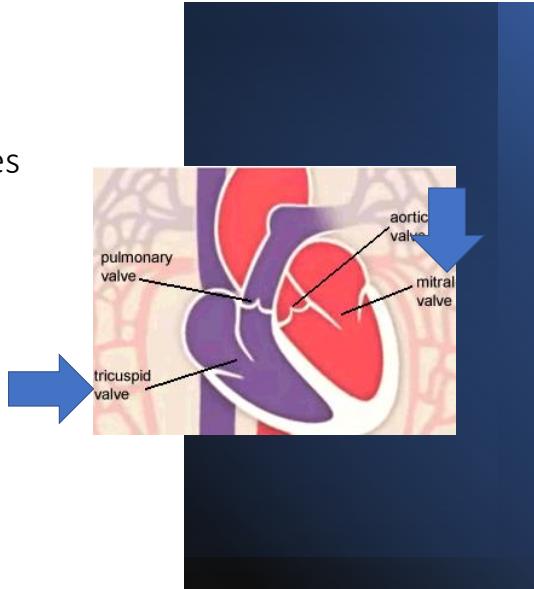
## Semilunar Valves

- Term comes from shaped—"half moon" semi-lunar
- **The Pulmonic Valve-**
  - Between right ventricle and pulmonary artery
- **The Aortic Valve-**
  - Between left ventricle and aorta



## Atrioventricular (AV) Valves

- **Tricuspid valve-**
- **3 leaflets**
- Separates-right atrium and right ventricle.
- **Mitral valve-**
- **2 leaflets (Bicuspid valve)**
- Separates-left atria and left ventricle

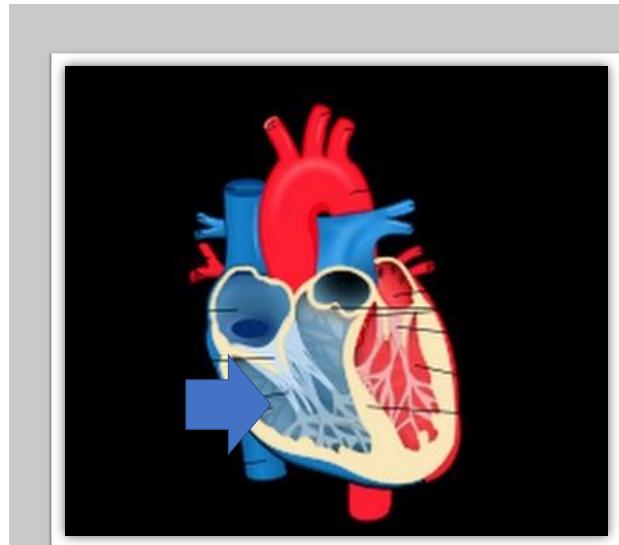


### TPMA-Valves

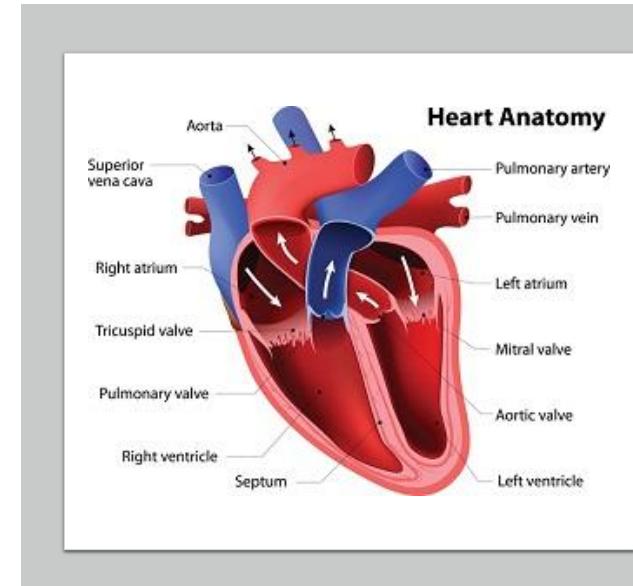
- Thoughtful People Manage Affirmations
- Tricuspid, Pulmonic, Mitral, Aortic

## Chordae Tendineae

- Anchors AV valves to floor of ventricles
- Prevents hyperextension of AV valves

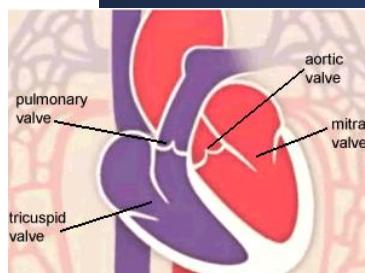


## Trace a Drop of Blood



## Heart Sounds

- Created by the opening and closing of valves
- **First sound-**
  - Closing of **Tricuspid and Mitral valves,**
- **Second sound-**
  - Closing of **Aortic and Pulmonary valves**



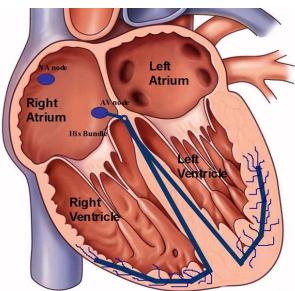
## Ventricles Pumping Force

EACH VENTRICLE PUMPS SAME AMOUNT OF BLOOD

LEFT SIDE OF HEART MUSCLE IS THICKER- PUMPS 5 TIMES FORCE

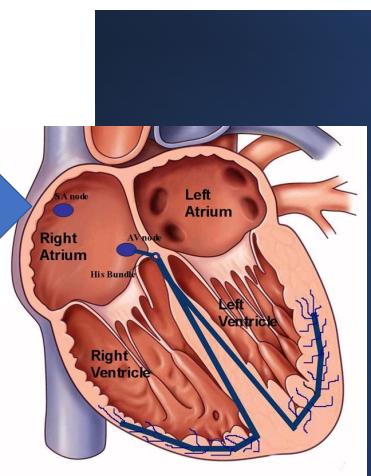
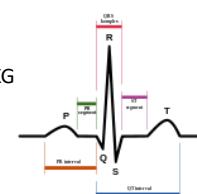
## Cardiac Conduction Pathway & Cardiac Cycle

- Specialized cells that create and conduct electrical impulses ...stimulates heartbeat



## Sinoatrial (SA) Node

- Located in upper right atrium
  - "Pacemaker" of the heart
- **Normal heartbeat from SA node-normal sinus rhythm**
- Heartrate 60-100 bpm
  - Causing the "P" wave on EKG



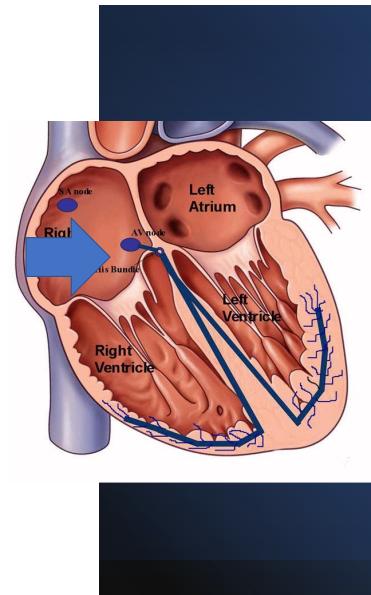
## Interatrial tracts

Conducts impulses to left atrium  
...both atria contract



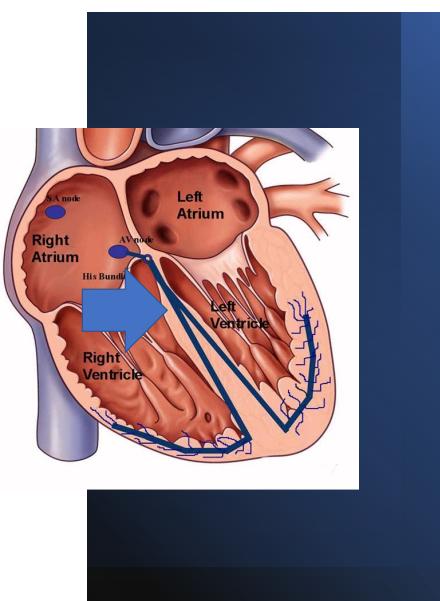
## Atrioventricular (AV) Node

- Located at the bottom of the right atria
- AV Node slows the impulse
- If SA node is nonfunctioning
  - AV node can initiate heartbeat
  - Slower rate-40-60 bpm



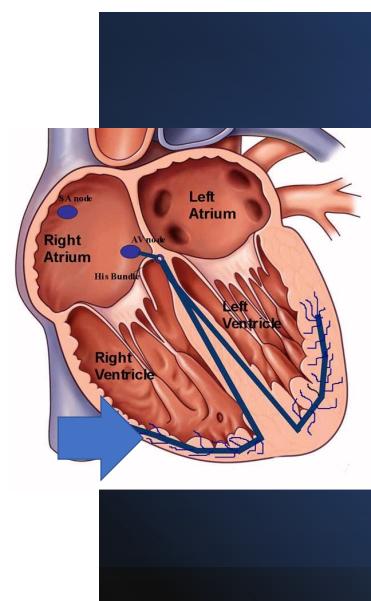
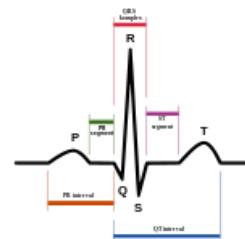
## Bundle of HIS

- Receives the impulse from the AV Node
  - Transmits the impulse to the left and right bundle branches
- If Bundle of His conducts heartbeat
  - Slower rate 20-35 bpm



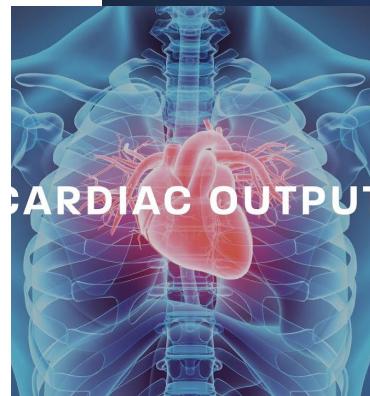
## Purkinje fibers

- Delivers the impulse to the myocardium of the ventricles
- Causing the "QRS complex"



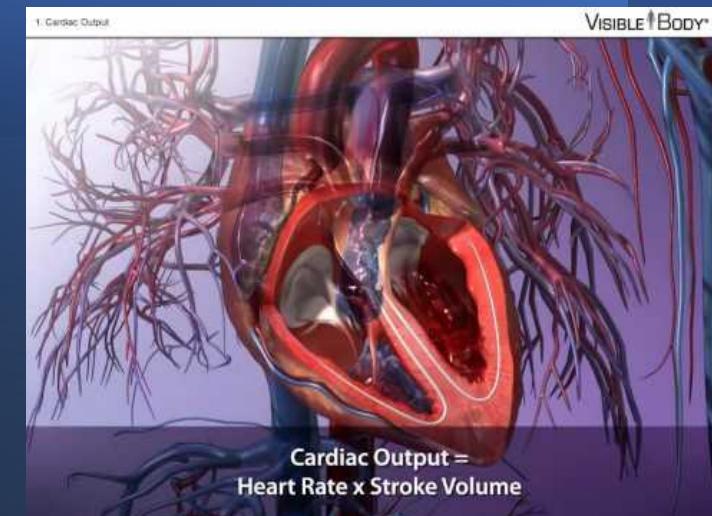
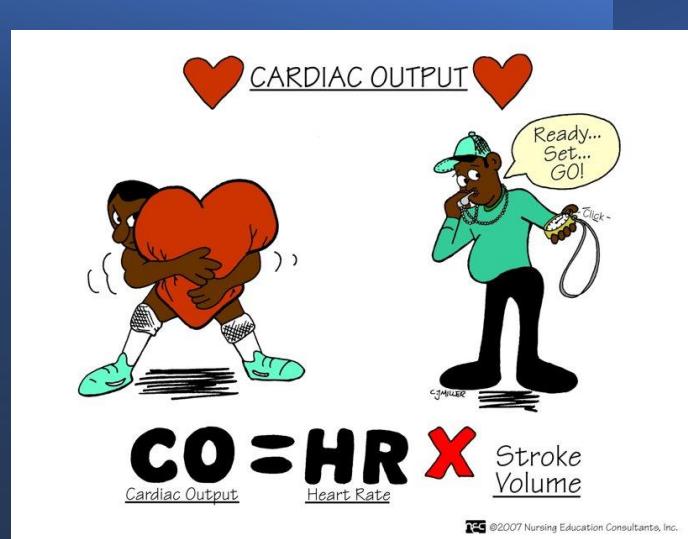
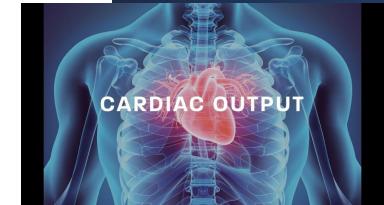
## Cardiac Output

- Amount of blood ejected from the left ventricle in one minute
  - At 75 beats/min- average 5-6 Liters of blood
- **Stroke volume**
  - Amount of blood ejected by a ventricle in one contraction
  - Generally, 60-80ml/minute
- **Ejection Fraction**
  - How well the left ventricle is pumping blood
    - Total amount of blood pumped out of the left ventricle during a contraction
    - Norm is 60%



## Cardiac Output-Starling's Law

- During exercise
  - Venous return increases
  - Contracts more forcefully
  - Increases stroke volume
  - More blood is pumped
  - Heartrate increases
  - Cardiac output increases
  - As much as 4 times resting level

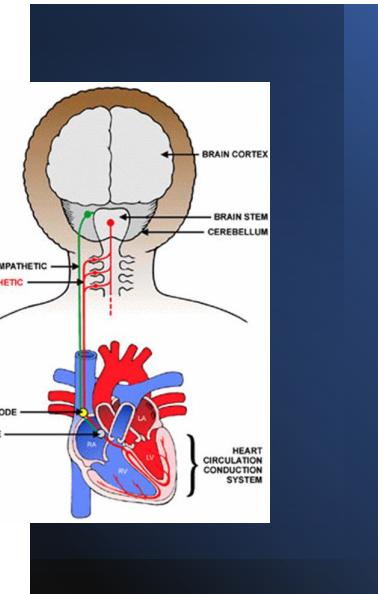


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# Blood Pressure

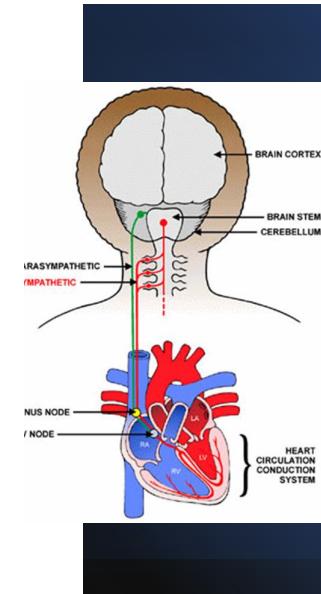
## Hormones & the Heart

- Epinephrine
  - Increases heart rate
  - Force of contractions
  - Dilates coronary vessels
  - In turn-increases cardiac output and systolic blood pressure
- Aldosterone
  - Helps regulate serum sodium and potassium
  - Necessary for cardiac electrical activity
- Atrial natriuretic hormone
  - Secreted by atria
  - Increases excretion of sodium in kidneys
  - Secreted when higher blood pressure or blood volume stretches walls of atria
  - Loss of sodium is accompanied by loss of water in urine
  - Decreases blood volume...and blood pressure



## Hormones & the Heart - Repeat it Back

- Epinephrine
  - \_\_\_\_\_ heart rate
  - Force of contractions
  - \_\_\_\_\_ coronary vessels
  - In turn-increases \_\_\_\_\_ and \_\_\_\_\_
- Aldosterone
  - Helps regulate serum \_\_\_\_\_ and \_\_\_\_\_
  - Necessary for \_\_\_\_\_ activity
- Atrial natriuretic hormone
  - Secreted by atria
  - Increases \_\_\_\_\_ of sodium in kidneys
  - Secreted when higher \_\_\_\_\_ or \_\_\_\_\_ stretches walls of atria
  - Loss of \_\_\_\_\_ is accompanied by loss of water in urine
  - Decreases blood \_\_\_\_\_ and blood \_\_\_\_\_



Force of blood against the walls of the blood vessels

Measured in mm Hg

Effected by many different things

- If HR and force increase... BP increases
- HR is increased... ventricles cannot fill completely before contracts... decreases output...decreasing BP

## Aging & Cardiovascular System

Aging of blood vessels - believed begin in childhood

With age, heart muscle become less efficient

Maximum cardiac output decreases

Heart rate decreases

Valves become thickened-leading to heart murmur

- Orthostatic hypotension risk and falls
- Assess orthostatic blood pressures-lying, sitting, standing
- Teach sit up and stand slowly before walking

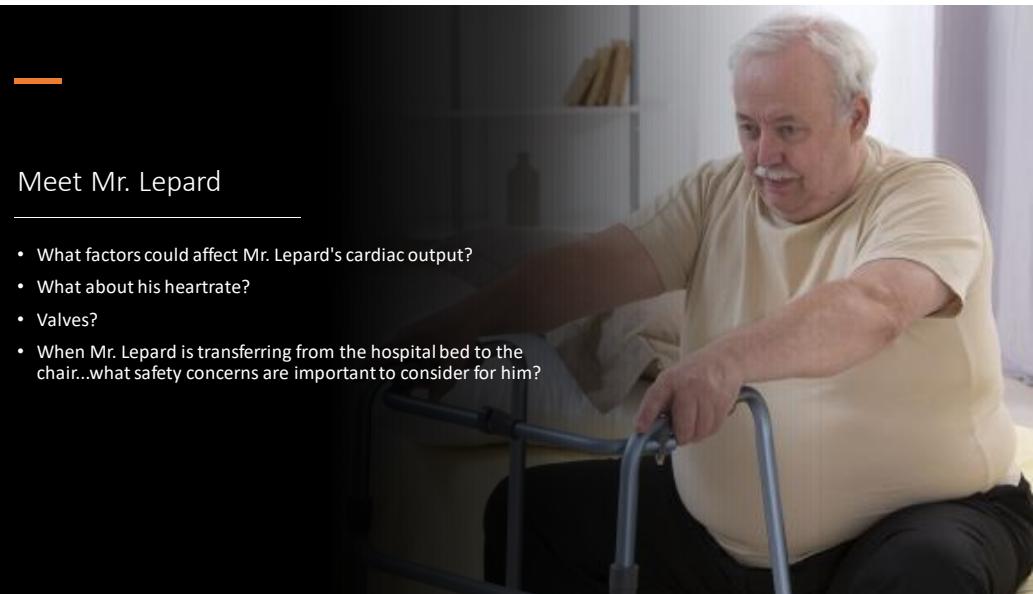
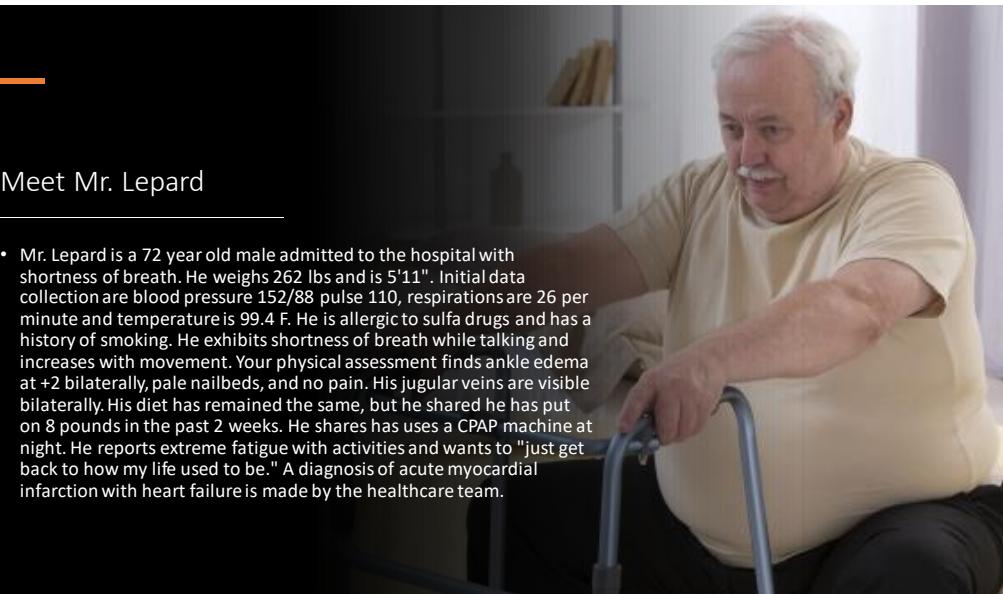
Atherosclerosis

- Deposition of lipids in walls of arteries
- Narrows arteries and may stimulate intravascular clot formation
- Decreases blood flow to organs

# Cardiovascular Disease

## Meet Mr. Lepard

- Mr. Lepard is a 72 year old male admitted to the hospital with shortness of breath. He weighs 262 lbs and is 5'11". Initial data collection are blood pressure 152/88 pulse 110, respirations are 26 per minute and temperature is 99.4 F. He is allergic to sulfa drugs and has a history of smoking. He exhibits shortness of breath while talking and increases with movement. Your physical assessment finds ankle edema at +2 bilaterally, pale nailbeds, and no pain. His jugular veins are visible bilaterally. His diet has remained the same, but he shared he has put on 8 pounds in the past 2 weeks. He shares has uses a CPAP machine at night. He reports extreme fatigue with activities and wants to "just get back to how my life used to be." A diagnosis of acute myocardial infarction with heart failure is made by the healthcare team.



## Meet Mr. Lepard

- What factors could affect Mr. Lepard's cardiac output?
- What about his heartrate?
- Valves?
- When Mr. Lepard is transferring from the hospital bed to the chair...what safety concerns are important to consider for him?

92.1 million adult Americans-1 or more cardiovascular disease

### Lifestyle leading risk

- Sedentary
- Excessive calories
- Smoking
- Uncontrolled hypertension
- Elevated serum glucose
- Elevated cholesterol
- Increased weight

Greatest cause of death for women is cardiovascular disease

## Social Determinants to Cardiovascular Risks

### Lower average income

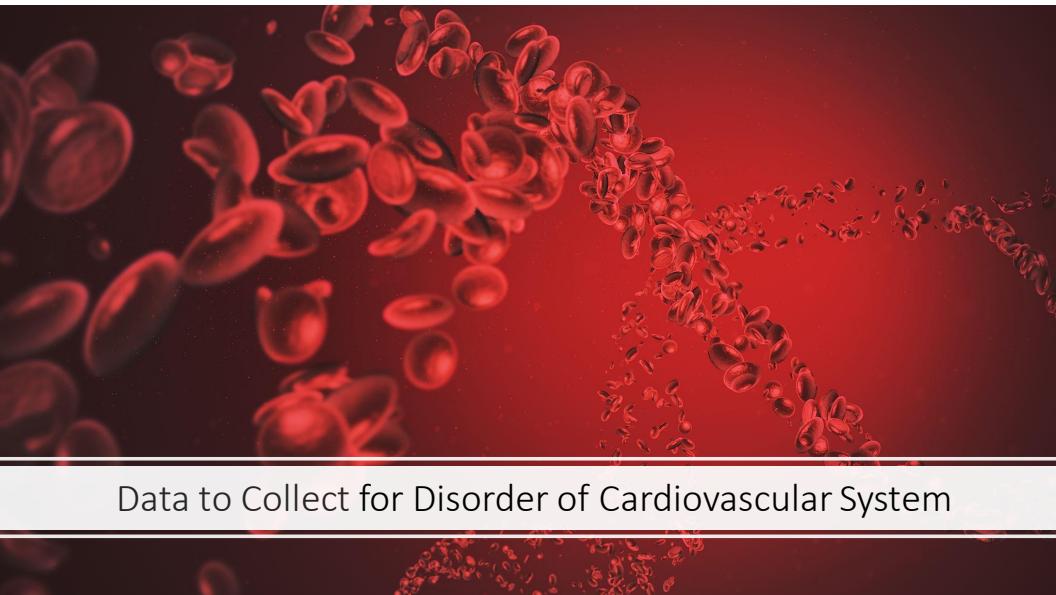
- Affecting where people live
- Access to health foods
- Safe places to exercise
- Access to quality healthcare

### Racial and ethnic groups

- Mexican Americans-tend to have higher rates of hypertension
- African Americans- Coronary heart disease mortality is higher
- Asian Americans-Stroke is leading cause of death for males

### Strategies

- Health promotion
- Disease prevention
- Education



## Data to Collect for Disorder of Cardiovascular System

# Nursing Assessment of Cardiovascular System

### Acute presentation

### Health History

- Allergies-meds and dyes
- Medications-influencing symptoms
- Medical/Surgical/Family
- Smoking
- Weight gain

### Pain

- Location, radiation, description
- Angina, MI, thrombus, embolism
- Arterial pain-sharp or throbbing
- Venous pain-fullness or heaviness

### Palpitations/Dizziness

- Arrhythmia-occur from ischemia, electrolyte imbalance, stress

### Dyspnea

- Left-sided heart failure; pulmonary edema, embolism

### Fatigue/limitations

- Walking
- Stairs
- Tasks

### Physical Examination

# Nursing Assessment of Cardiovascular System

### Acute presentation

- Focus on most serious signs and symptoms, physical data
- Older population-may present non-typical s/s of myocardial infarction (MI)
  - Dyspnea only
  - Chest pain may...or may not... be present

### Health History

### Physical Examination

# Nursing Assessment of Cardiovascular System

### Acute presentation

### Health History

### Physical Examination

- Blood Pressure
  - Hypotension, hypertension
- Pulses
  - Bradycardia, tachycardia, rhythm
- Respirations
  - Tachypnea, apnea

### Inspection

- Edema
  - Jugular vein distention

### Palpation

### Auscultation

- Cough, sputum
  - Crackles, wheezes

## Physical Examination- Blood Pressure

- Compare each arm's readings
  - Differences- Report to provider
- Arm with higher reading-Used for ongoing measurements
- Orthostatic Blood Pressure
  - Lying, sitting, standing
  - Determine changes
  - Normal:
    - Systolic-drops 15 mm/Hg
    - Diastolic-drop or increase in diastolic of 3-10 mm/Hg
    - Heartrate-increase 15-20 bpm to maintain cardiac output
  - Causes of orthostatic hypotension
    - Deficient fluid volume
    - Diuretics
    - Analgesics
    - Pain



## Physical Examination- Pulse

### Apical for 1 minute

- Regular or irregular rhythm
- Character
- Rate

### Compare to radial rate-assess equality

- If fewer radial beats than apical-Pulse deficit
- Report to healthcare provider

### Palpate bilateral arterial pulses

- Volume, pressure, and quality
- 4 point scale
- 0-absent
- 1+ weak, thready
- 2+ normal
- 3+ bounding
- "Thrill"-Bulging or tapping felt-defective heart valve
- "Bruit"-humming sound- obstruction or high flow of blood-plaque in arteries...increased risk of stroke
- Sclerotic- vessel feels stiff

## Physical Examination-Respirations

1

Assess:  
• Rate  
• Ease  
• Sounds

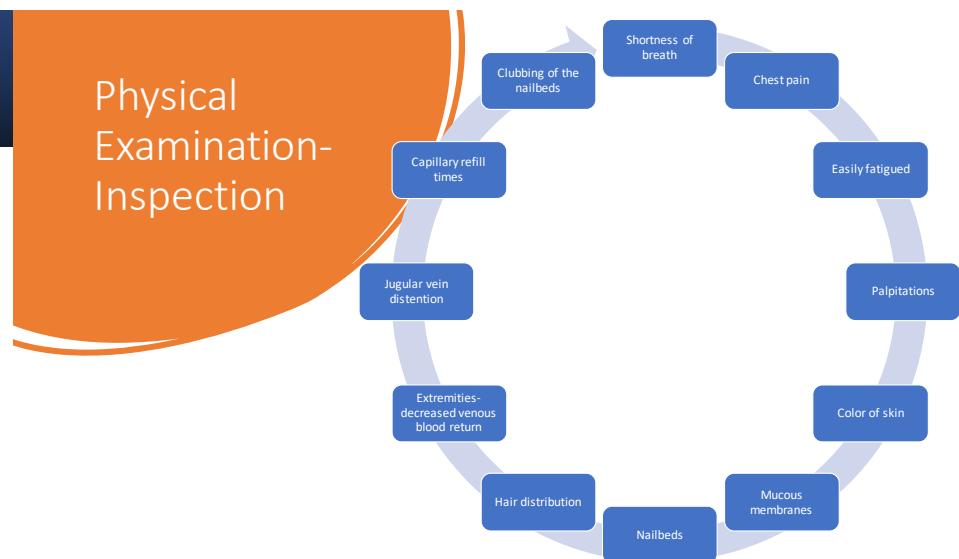
2

Assess sputum  
• Amount  
• Color  
• Consistency  
• Pink, frothy sputum-indicator of heart failure  
• Blood backs up in pulmonary veins & lungs

3

Assess cough  
• Dry cough-irritation from lung congestion of acute heart failure

## Physical Examination- Inspection



# Physical Examination-Palpation

## Physical Examination-Inspection

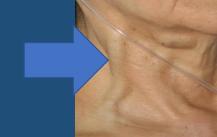
- Shortness of breath
- Chest pain
  - Onset, location, frequency, duration, radiation
  - May occur with stress
  - May radiate to arm or jaw
- Easily fatigued
  - Can't perform usual activates
  - Intolerance of exercise or exertion
  - Dizziness
- Palpitations
- Oxygenation status
  - Skin
    - Cyanosis
    - Pallor
    - Shiny, taut, dry
- Mucous Membranes/Lips-Dry

- Hair-decreased
  - Reduced arterial blood flow
- Venous blood return
  - Extremities
  - Varicose veins
  - Stasis ulcers
  - Scars around ankles
  - Thrombophlebitis
    - Swelling
    - Redness
    - Hard tender vein

## Physical Examination-Inspection

### Jugular neck veins

- Distention
- 45-90 degree upright position
- Indicates-increase venous volume-right sided heart failure



- Nails-
- Thick, brittle nails
- Clubbing
  - Oxygen deficiency
  - Distal fingers & toes swell; appear clublike
- Report to HCP



### Capillary refill time

- Normally less than 3 seconds
- Reflects arterial blood flow to extremities
- Anemia or decrease in blood flow to extremity

### Point of maximum impulse (PMI)

- Right hand over apex of the heart
- Thrust is felt when ventricles contract
- Enlarged heart-left of midclavicular line

### Temperature of extremities

- Compare right to left
- Poikilothermy:
  - Extremity is same temperature of room
  - Due-lack of arterial blood flow

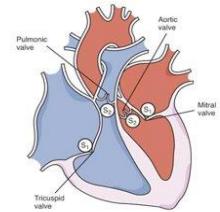
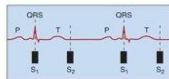
### Edema

- Right sided heart failure

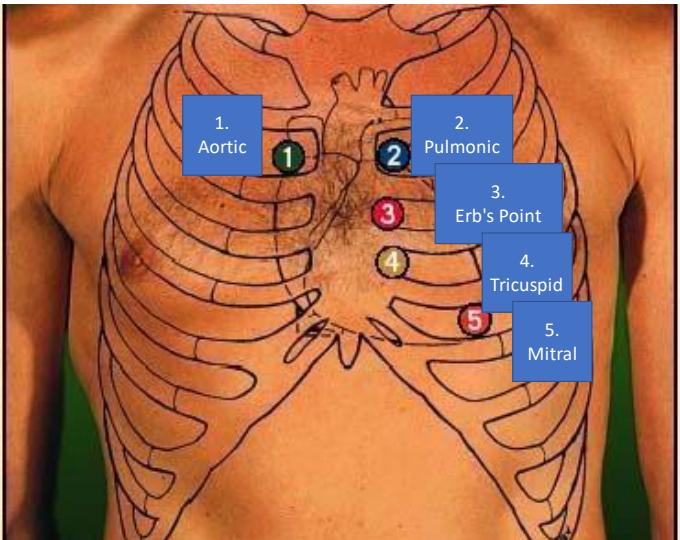
## Physical Examination-Auscultation

- S1-AV valves
- S2-Aortic and Pulmonary valves
- Murmurs Causes-(Erb's Point)
  - Valves
    - Narrow opening
    - Does not close tightly
- Pericardial Friction Rub Causes
  - Inflammation pericardium & epicardial layers
  - Sandpaper-like sound
  - Best heard-left of the sternum
  - May occur after MI or chest trauma

<https://www.youtube.com/watch?v=C3HDROvvF3o>



## Locating Assessment Points



## Six P's Characterize Peripheral Vascular Disease

Pain

Paresthesia  
• Loss of sensation

Pallor

Pulselessness

Paralysis

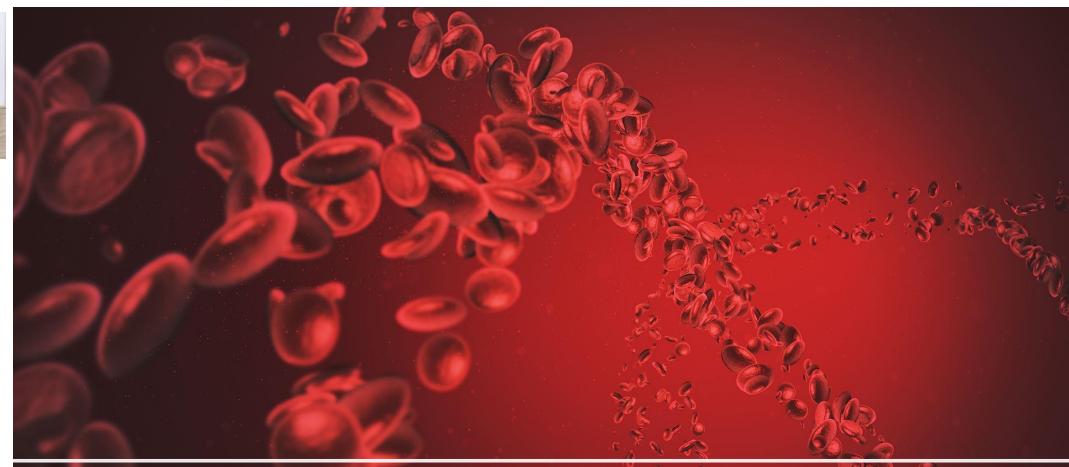
Poikilothermic  
• Assumes temperature of environment

## Caring for Mr. Lepard



- Mr. Lepard's presentation:
  - Shortness of breath
  - V/S: B/P152/88, P-110, R-26, Temp- 99.4 F, Pain-0
  - He is allergic to sulfa drugs
  - Smokes
  - Shortness of breath with talking and movement
  - Ankle edema at +2 bilaterally
  - Pale nailbeds
  - Jugular veins-visible bilaterally
  - Weight increase 8 pounds past 2 weeks
  - Extreme fatigue with activities

- Mr. Lepard does not present with chest pain...even though the diagnosis is an acute MI...Is this a normal finding? If so, Why?
- What S/S are present that makes the provider believe Mr. Lepard has heart failure?



Diagnostic Test for Cardiovascular Patient

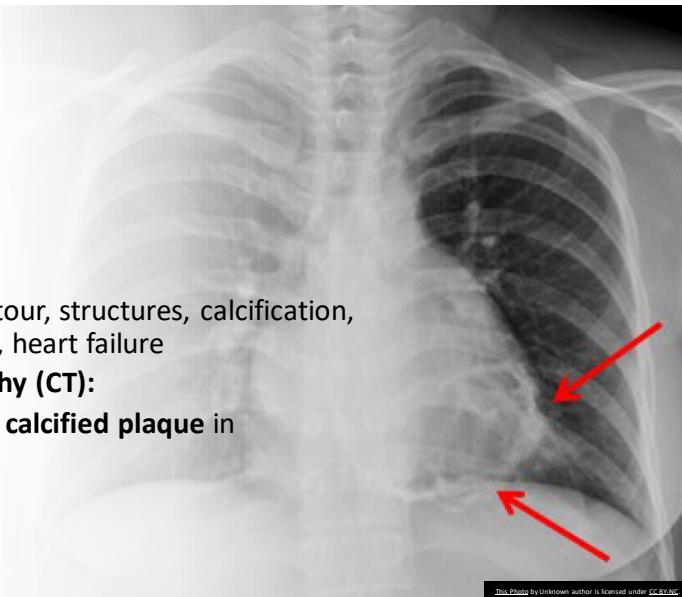
## Noninvasive Studies

- **Chest X-Ray:**

- Size, position, contour, structures, calcification, fluid around heart, heart failure

- **Computed Tomography (CT):**

- Calcium scoring of **calcified plaque** in coronary arteries

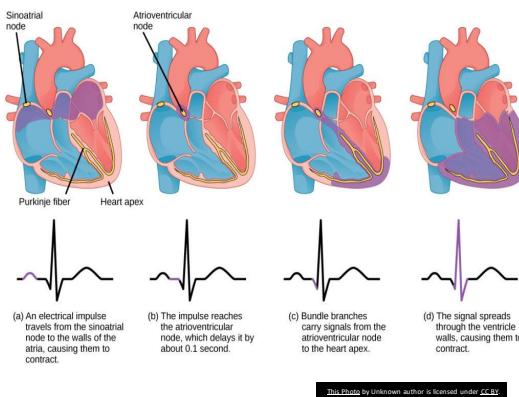


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## Noninvasive Studies

- **Electrocardiogram (ECG):**

- Records **electrical activity of heart**
  - Conduction, rate, rhythm, enlargement, ischemia, MI
- **Holter monitor**-Ambulatory ECG worn for 48 hours or longer
  - Patient goes about daily activities
  - Patient diary may be used

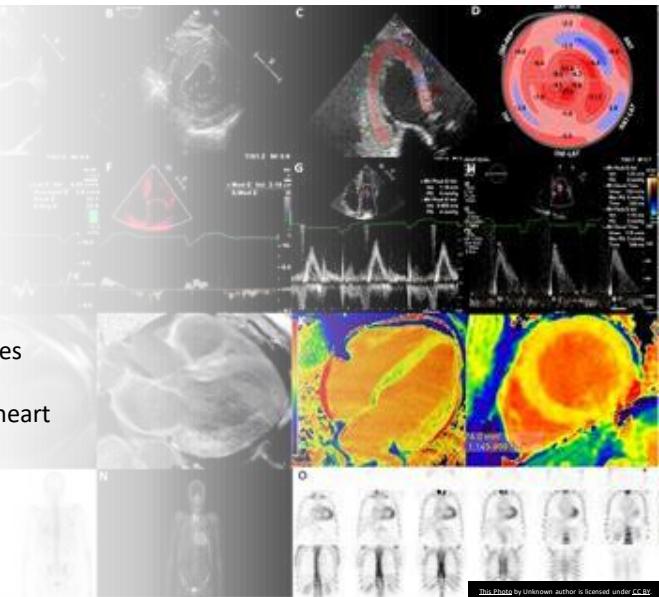


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## Noninvasive Studies

- **Coronary Magnetic Resonance Imaging (MRI) and Angiography (MRA):**

- 2 or 3 dimensional images of beating heart
- **Identifying ischemia & heart damage**



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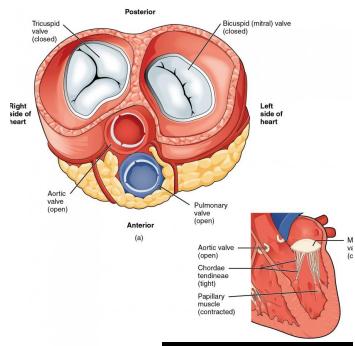
## Noninvasive Studies

- **Echocardiogram:**

- Ultrasound
- **Used to diagnosed valvular diseases**
- Records motion of heart structures, size, shape, position

- **Exercise Stress Echocardiogram:**

- Shows exercise induced cardiac ischemia
- Diagnose coronary artery disease



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# Noninvasive Studies

- **Exercise Stress Test:**
    - Measures **cardiac function** or peripheral vascular disease during exercise
    - 12 Lead ECG applied
    - Test instructions
      - Do not smoke, eat, or drink for 2-4 hours before test
      - Wear comfortable walking shoes and clothing



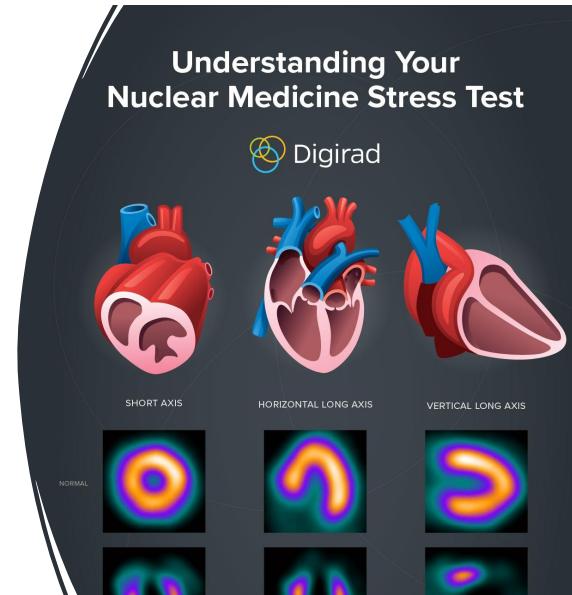
# Noninvasive Studies

- Tilt table test:
    - Diagnose cause of **syncope**
    - HR & BP monitored during position changes



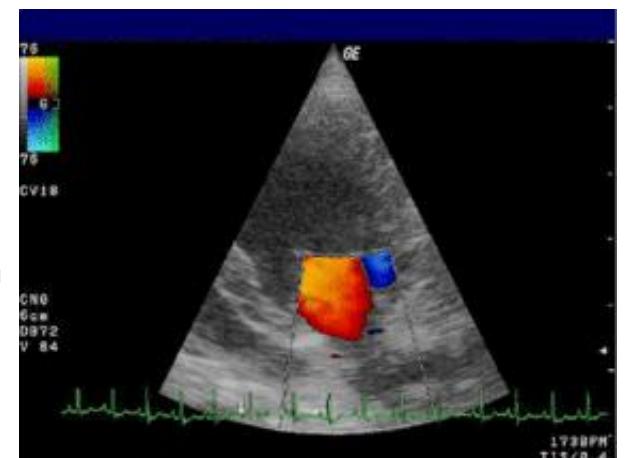
# Noninvasive Studies

- Nuclear Radioisotope Imaging:
    - IV radioisotopes
    - Scanned with gamma camera
    - Detect **myocardial ischemia**, **MIC**, **cardiac blood flow**
    - Ventricle size and motion



# Noninvasive Studies

- **Doppler ultrasound:**
    - Sound waves bounce off blood cells and return in relationship to amount of **blood flow**
    - Decreased blood flow creates decreased sound waves



## Blood Studies- Cardiac Biomarkers

Proteins and enzymes

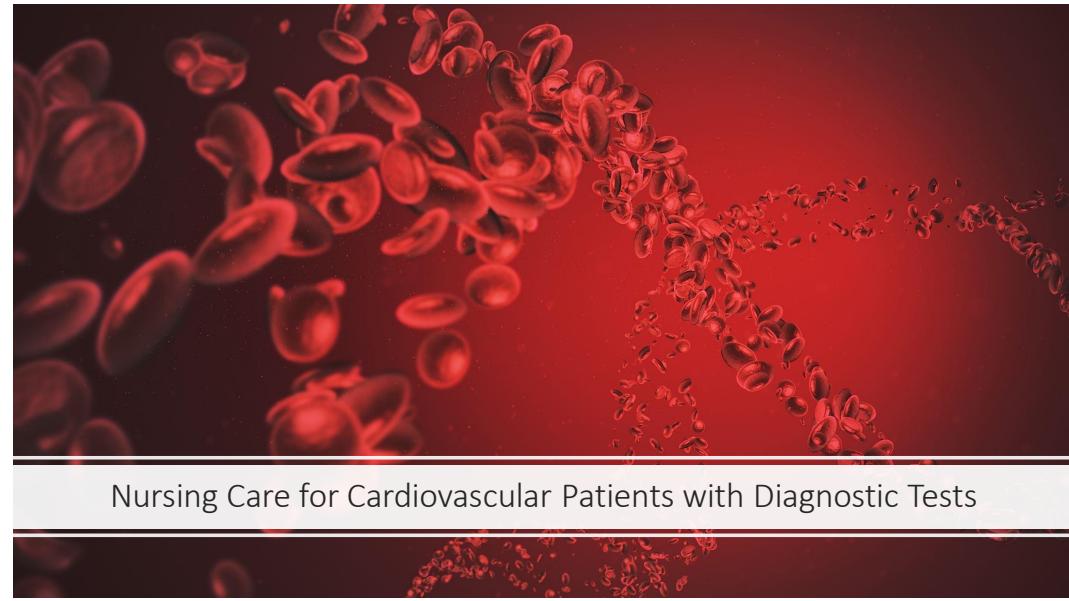
Released into blood by damaged cardiac cells

Helps to identify if recent MI

## Meet Mr. Lepard

- Mr. Lepard asks you what are the differences in the non-invasive studies of:
- Chest x-ray
- Computed Tomography (CT)
- Electrocardiogram (ECG)
- Echocardiogram

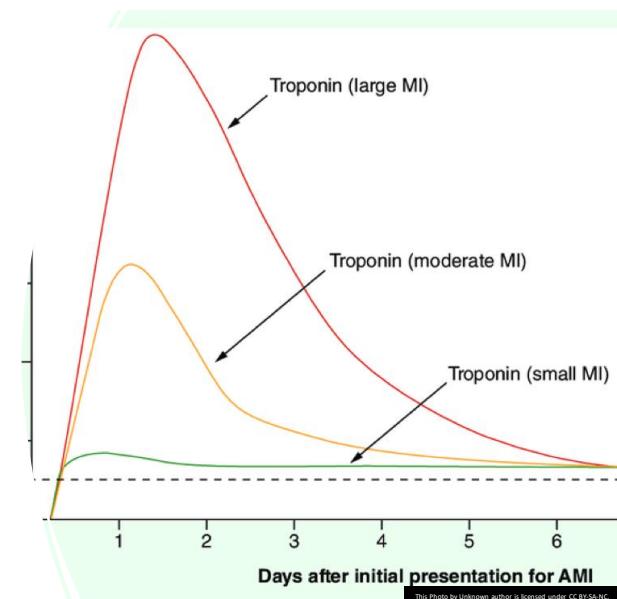
What do you tell him?



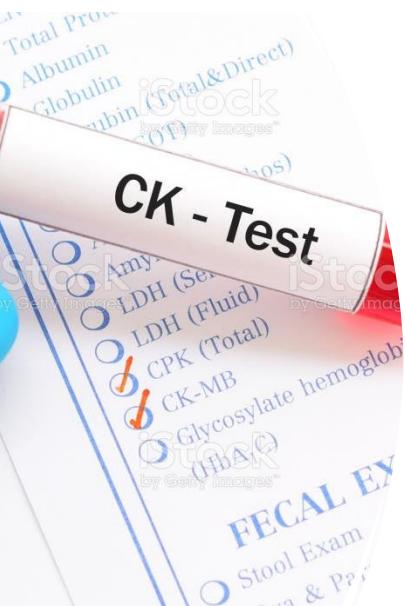
Nursing Care for Cardiovascular Patients with Diagnostic Tests

## Blood Studies- Cardiac Biomarkers

- **Cardiac Troponin**
  - Protein
  - Troponin I & Troponin T- contracts cardiac muscles
- **Following a MI:**
  - Levels rise within 4-6 hours
  - Levels peak in 10 to 24 hours
  - Levels stay elevated 7-14 days



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# Blood Studies-Cardiac Biomarkers

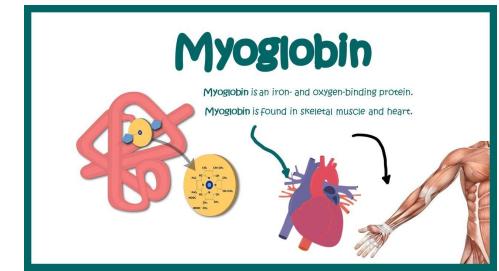
- Creatine Kinase

- Enzyme
- Following MI:
  - Levels rise within 4-6 hours
  - Peaks in 12-16 hours
  - Returns to normal in 24 to 36 hours
  - Invasive procedures (IV and IM injections) are avoided before drawing CK-
    - Prevent elevation in CK levels from cell trauma

# Blood Studies-Cardiac Biomarkers

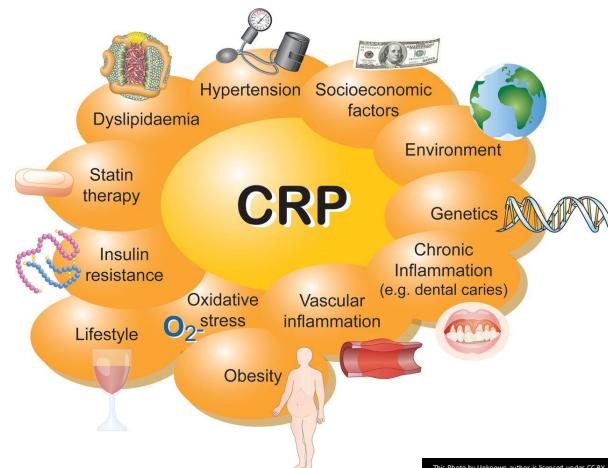
- Myoglobin

- Protein
- Not specific to cardiac muscle
- Can only indicate muscle damage
- Rises before CK or troponin
  - Can detect MI earlier
- Levels elevate within 1 hour of MI
- Peak 4-12 hours
- Levels elevated for 18 hours following chest pain



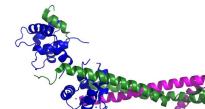
## Blood Studies-C-Reactive Protein

- Protein
- Increases during inflammatory process
- Can predict heart attack risk
- With elevated levels
  - Opportunity to help patients understand and reduce cardiac risks



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## Blood Studies-Cardiac Biomarkers

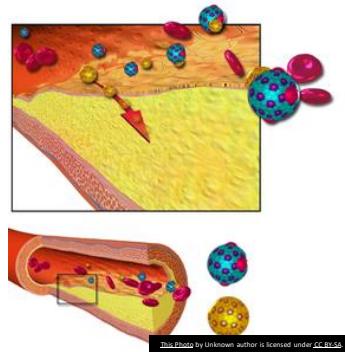


Cardiac Biomarker	Type	Level rises when	Level peaks when	Levels remain elevated until	Specifics
Troponin I & T	Protein	4-6 hours	10-24 hours	7-14 days	Contracts cardiac muscle
Creatine Kinase (CK)	Enzyme	4-6 hours	12-16 hours	24-36 hours	Avoid IV/IM-prevent elevation from cell trauma
Myoglobin	Protein	1 hour	4-12 hours	18 hours	Not specific to cardiac; rises before CK
C-Reactive Protein	Protein	4-6 hours	2-4 days	7-10 days	Reflects inflammation; predict risk to educate patient

Biasucci, L., Koenig, W., Mair, J., Mueller, C., Plebani, M., Lindahl, B., ... Giannitsis, E. (2013). How to use C-reactive protein in acute coronary care. European Heart Journal, 34(36), 3687-3690.

# Blood Studies-Homocysteine

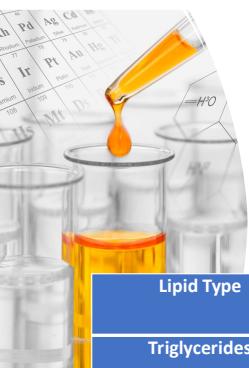
- Serum Amino Acid
- Can damage lining of arteries and promote blood clots
- Elevated levels associated
  - Increased cardiovascular risk
- Folic acid, vit. B6, Vitamin B12-
  - Break down homocysteine



# Blood Studies-Lipids

- Lipid profile can screen for risk of coronary artery disease
- Patients fast for 12 hours and avoid alcohol for 24 hours prior to test

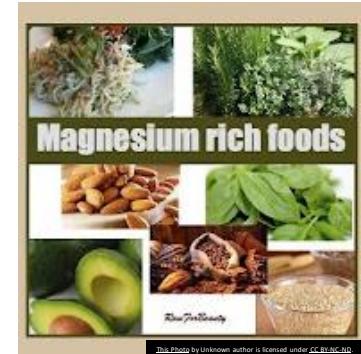
# Blood Studies-Lipids



Lipid Type	Definition	Abbreviation	Influence
Triglycerides	Very low-density lipoproteins	VLDL	Increases risk
Cholesterol	Low-density lipoproteins	LDL	Increases risk
Phospholipids	High-density lipoproteins	HDL	Decreases risk

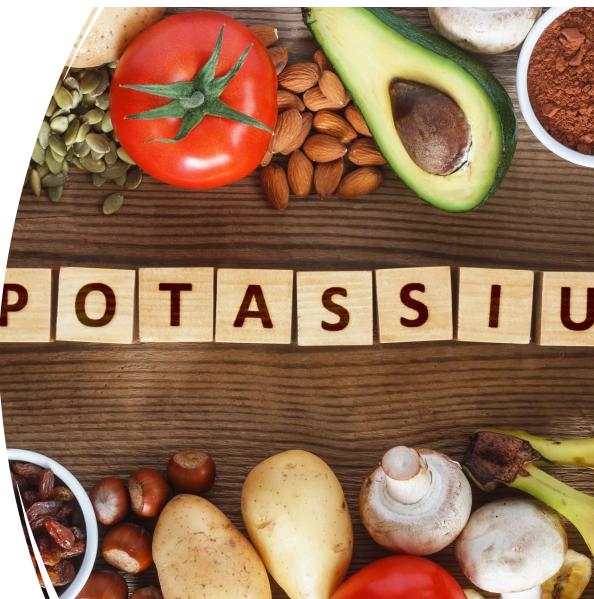
# Blood studies- Magnesium

- Electrolyte
- Controls heartbeat
- Regulates blood pressure
- Low levels-can cause cardiac arrhythmias, hypertension, tachycardia
- Low causes
  - Diuretics
  - Digitalis
  - Some antibiotics
  - Diabetes
  - MI



# Blood Studies- Potassium

- Electrolyte
- Essential for normal cardiac function
- Low levels-can cause weak, irregular, thready pulse
- High levels-can cause muscle twitches, cramps, muscle weakness, irregular heart rate, weak pulse



# Invasive Studies- Cardiac Catheterization

## • Measures

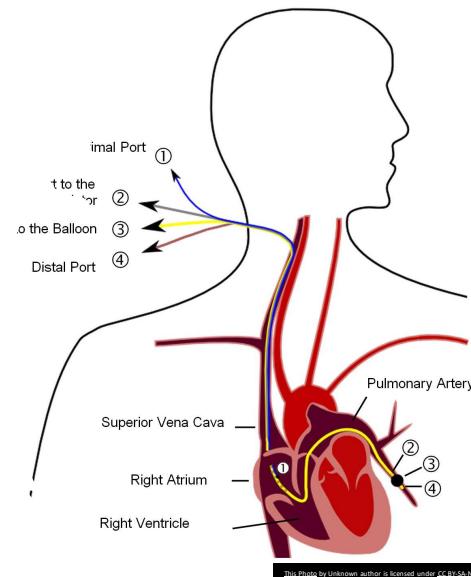
### • Cardiac pressures

- Chambers
- Great blood vessels
- Coronary arteries
- Cardiac output & oxygen saturation

## • Visualize

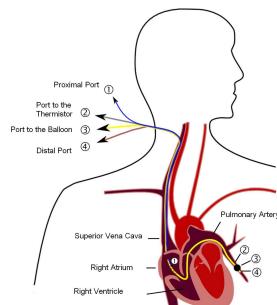
### • Cardiac vessels

- During the cardiac catheterization-
- If needed-angiogram & angioplasty can be performed



# Invasive Studies- Cardiac Catheterization

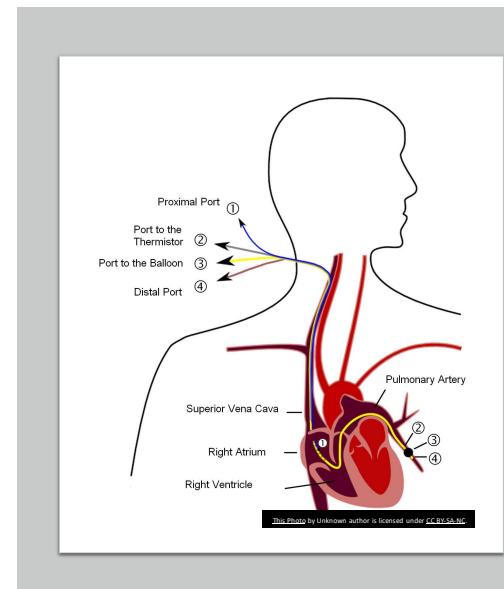
- Before test:
  - Assess
    - Allergies to dye
    - NPO for 8 hours
    - Vital signs
    - ECG constantly
    - Pulses
  - Educate
    - Will be awake
    - Warm, flushing sensation may be felt when dye is injected



# Invasive Studies- Cardiac Catheterization

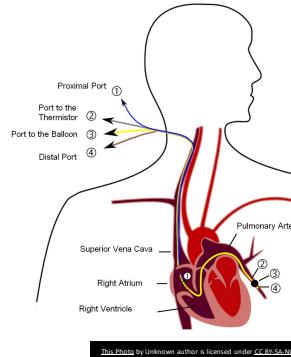
## • After test:

- Bedrest
- Pressure to puncture site
  - Hemorrhage
  - Hematoma
- Assess
  - Vital signs
  - Puncture site
  - Pulses
- Intake and output
  - Eliminate dye



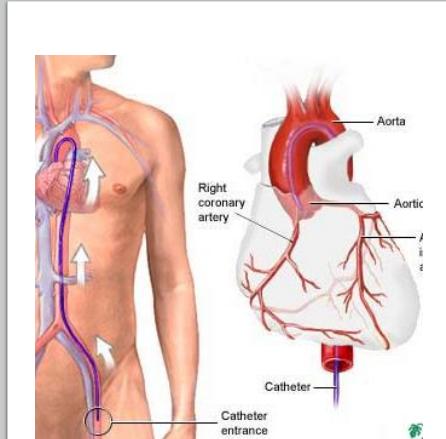
# Invasive Studies-Cardiac Catheterization

- Potential Complications:
  - Loss of circulation to area of insertion
  - Allergic reaction to dye
  - Hemorrhage
  - Embolism
  - Hematoma
  - Arrhythmias
  - MI/cerebrovascular accident
  - Rupture of heart chambers
  - Kidney injury



# Invasive Studies-Angiography/Angioplasty

- Also known as "cardiac catheterization"
- Dye is injected into vascular system-**visual the cardiac vessels**
- **Assess Lower extremities before and after procedure**
- Evaluates
  - Cardiac clots
  - Peripheral vascular disease (PWD)
  - Potential graft site



# Invasive Studies-Angiography/Angioplasty

## Before Procedure

- Assess Allergies
  - Contrast dye
- NPO
- Baseline Assessment
  - Head to toe
  - Kidney function-remove dye
  - **Lower extremities**
    - Pulses
    - Warmth
    - Color
- Educate
  - Dye produce burning when injected

## After Procedure

- Assess
  - Vital signs
  - Allergic reaction signs
  - Injection Site
    - Hemorrhage
    - Hematoma
    - Thrombosis
- **Lower extremity**
  - Pulses
  - Warmth
  - Color

# Invasive Studies-Angiography/Angioplasty



<https://www.youtube.com/watch?v=e13TGGccvT4>

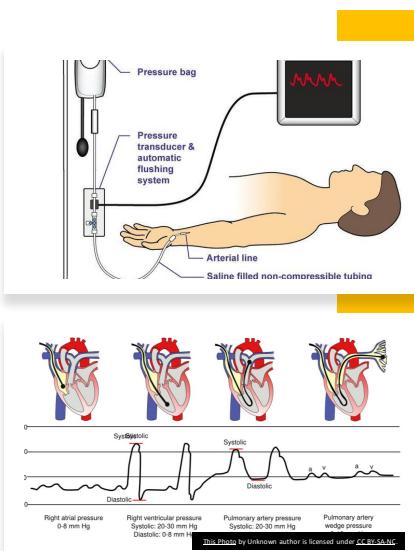
## Invasive Studies

### Hemodynamic Monitoring

- Arterial Line Catheter-attached to transducer, monitors
  - Arterial blood pressure
  - Cardiac output
  - Inserted into radial or femoral artery... to vena cava or pulmonary artery

### Determines

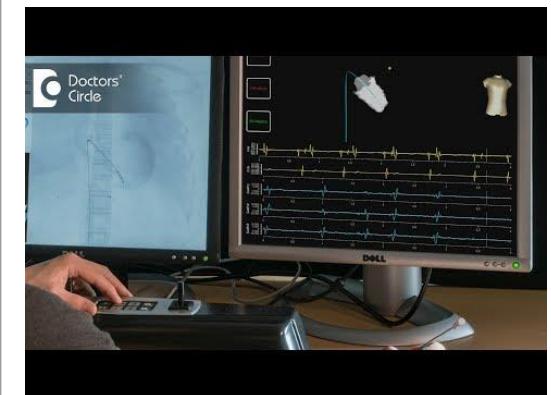
- Organ perfusion
- Pressure of ventricles (Preload)



## Invasive Studies

### Electrophysiologic Study

- Catheters with electrodes inserted
  - Femoral vein to right side heart
- Electrical impulses are recorded
- Pacing can be done
- Arrhythmias can be triggered to diagnose why they occurring
- NPO for 8 hours prior to test



<https://www.youtube.com/watch?v=A7mLsjtvxY>

## Therapeutic Measures- Cardiovascular System

### Therapeutic Measures for Cardiovascular Disorders

#### Health Promotion and Lifestyle Changes

- Diet-limit fats and sodium
- Exercise
- Smoking Cessation
- AntieMBOLISM Devices

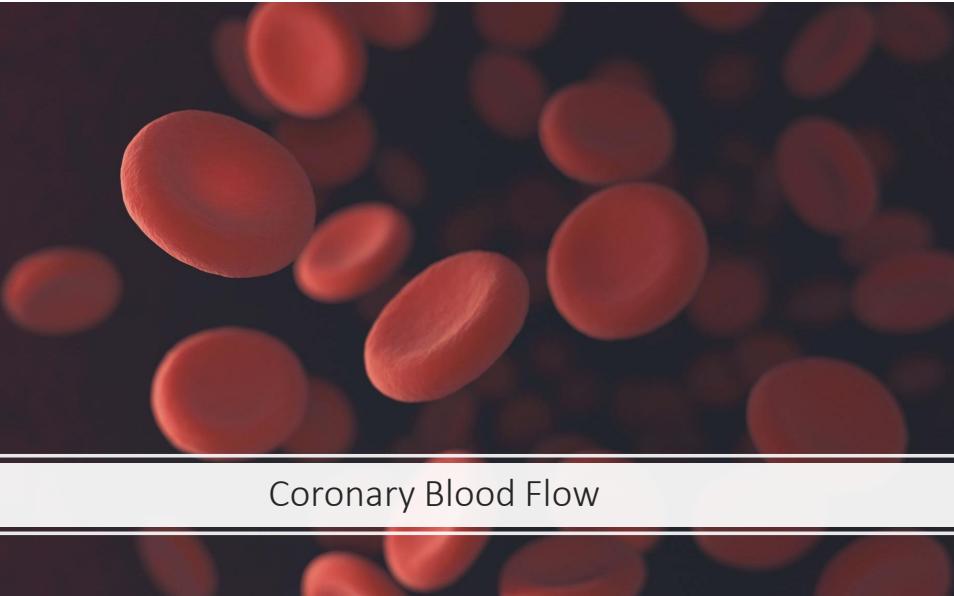
#### Oxygen

- Oxygen to heart to function

#### Medications

- Antiarrhythmics
- Antianginals
- Anticoagulants
- Cardiac glycoside
- Thrombolytics
- Vasodilators

#### Cardiac Surgery



Coronary Blood Flow



Preoperative and Postoperative Care for Cardiac Surgery

## The 3 Coronary Arteries

### Left Anterior Descending (LAD)

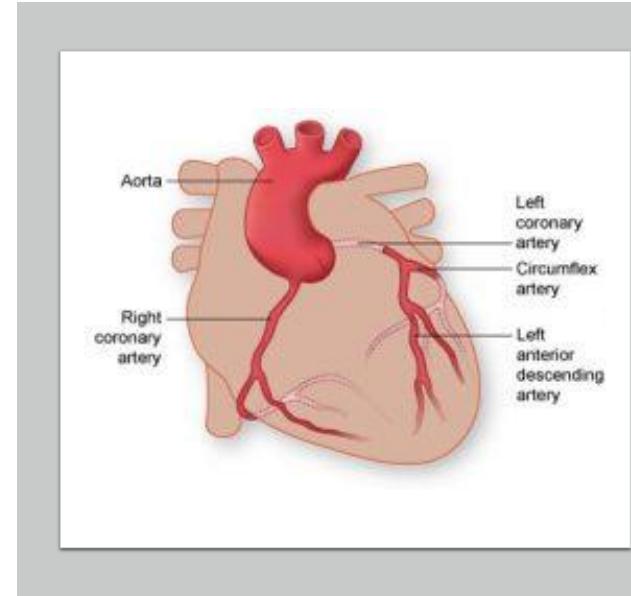
- Provides blood flow to anterior wall of left ventricle

### Circumflex

- Provides blood flow to left ventricle

### Right Coronary Artery (RCA)

- Provides blood flow to right ventricle & inferior wall of left ventricle



## Cardiac Surgery- Pre & Post Preparation

### Assessment

- Insertion site-pulses
- Lab Test results
- Lower extremities
- Urinary output
- Pain
- Hydration
- Skin assessment
- Bowel sounds
- Bedrest

### Medications

- Diuretics
- Anticoagulants
- Pain

### Education

- Coughing and deep breathing exercises
- Incision care and location
- Pain management
- Equipment
- Urinary catheter
- Family waiting room
- Intubated
- Chest tube



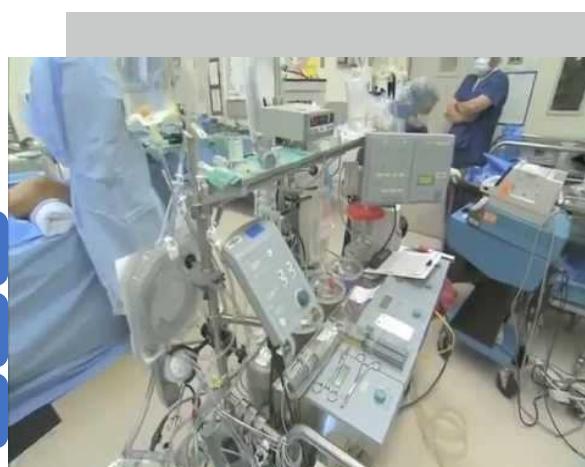
## Cardiac Surgery- Cardiopulmonary Bypass Pump

Temporarily drives blood away from heart and lungs

Prior to Pump-Anticoagulated with heparin

Immediately before ending pump

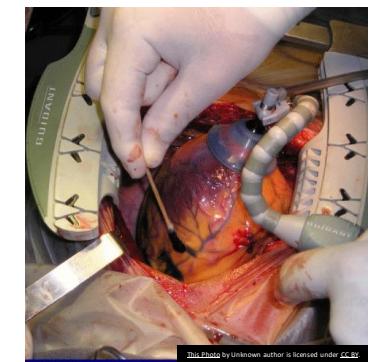
- Heparin affects are reversed
- Protamine sulfate (Antidote for heparin)
- Potential complication-excessive bleeding



<https://www.youtube.com/watch?v=jAK40N2vt8o>

## Cardiac Surgery- General Procedure After Pump

- **During surgery:**
  - Solution is infused into aorta with iced saline
    - Causes heart to standstill
- **After surgery:**
  - Blood is warmed in bypass circuit
  - Patient is slowly weaned off bypass
  - Heart starts beating again...bypass is discontinued
  - Chest tubes placed-drain blood and fluid from chest
  - Cardiac rehabilitation program



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## Mr. Lepard's Cardiac Catheterization

Mr. Lepard is having a cardiac catheterization today.



### Nurse to Nurse Report:

Mr. Lepard is a 72 year old male status post cardiac catheterization originally admitted for shortness of breath, subsequently with acute myocardial infarction and heart failure. He weighs 262 lb and is 5'11". He is allergic to sulfa drugs and has a 20 year history of smoking 2 packs of cigarettes a day. He has +2 edema bilaterally on his lower extremities. Conscious sedation with IV Versed and fentanyl was given for the procedure. The cardiac cath. revealed moderate narrowing of 2 coronary arteries of 60% blockage that were treated with angioplasty stents. Cath was introduced in the right femoral artery. All pulses are equal, laterally without evidence of hematoma. Lower extremities are pink, warm, and moving toes. He has reported no pain at the site. He has an 18 gauge IV in the right arm with LR at 125cc per hour with 700 cc left in the bag. Foley catheter is draining clear, amber colored urine, and has had 60 cc per hour of output since procedure. Last vital signs were Temp. 98.6, P 80, R 20, 02 sat 94% on room air, BP 130/70. He has been on bedrest since the procedure, sandbag is in place over the insertion site, and he has a pressure dressing in place under the sandbag.



**Hospital Provider's Orders****Patient Name:** Donald Lepard**DOB:** 05/09/1949**MRN:** 06759820**Date:** Time: **Order:**

2/1/2022 1400

**Vital signs & vascular checks:** every 15 minutes for 1 hour, every 30 minutes for 2 hours, every 4 hours**Diet:** Low salt, 2000 calorie, encourage po fluids**Activity:** bed rest with Right leg immobilized for 6 hours**IV Therapy:** LR @ 125 cc/hr**Foley catheter:** Discontinue catheter in AM**Intake and Output:** monitor I&O and report to provider output less than 30cc per hour**Medications:** Metoprolol 25 mg po 0900

Lipitor (Atorvastatin) 10 mg po 0900

Morphine Sulfate 4 mg IV every 4 hours prn chest pain, may repeat once

**Diagnostic Studies:** 12 Lead ECG every AM

Place on telemetry monitoring

**Clinical Questions:**

- What are safety concerns for Mr. Lepard?
- What would you expect to be on the insertion site?
- What assessments would you focus on?
- What signs and symptoms would indicate hypovolemia related to blood loss?
- What is a major concern with the use of the radiological dye to what organ?

**Clinical Questions:**

- Cardiac catheterization is most performed via access through right femoral artery. After catheterization, the nurse conducts a routine pulse assessment. Which pulses are typically checked?
- Mr. Lepard's vital signs before the procedure were: Temp. 98.6, P 80, R 20, O<sub>2</sub> sat 94% on room air, BP 130/70. After the procedure, his vital signs are temp 97.6, P 115, R 24, O<sub>2</sub> sat 90% on room air, BP 90/50.
  - These findings suggest: Normal findings? Hypovolemia? Pain? DVT?
- What may you expect to see when assessing his insertion site?
- Mr. Lepard is needing 1 unit of packed red blood cells. You assess his IV site and noticed that he has an 18 gauge catheter in his right arm. You believe that you can use the site to administer the blood, because...

