

CARDIAC

LPN & NSG II

Heart Structures

Right Atria- receives deoxygenated venous blood returning from the body –low pressure chamber

Left Atria- Receives oxygenated blood from the lung

Interatrial septum -separates the two atrias, location of foreman ovale in fetal circulation

Right Ventricle-Pumps deoxygenated blood to the right and left lung

Left Ventricle- Pumps oxygenated blood to the body

Interventricular septum- separates the two ventricles

Atrio-ventricular Valves-

Right side-tricuspid valve three flaps

Left side - bicuspid or mitral valve- two flaps

Semilunar Valves- prevent back flow of blood into the ventricles. Pulmonary semilunar valve between right ventricle and lungs Aortic valve (also a semilunar valve) separates the left ventricle from the aorta

Blood flow

Oxygen Poor Blood drains to the Rt. Atria from the body via the Superior and Inferior Vena Cava. Passes from Rt. Atria through tricuspid valve to Rt. ventricle

Rt. ventricle contracts forcing blood through pulmonary valve to lungs via

the Rt. and Lt. pulmonary arteries – only artery that carries deoxygenated blood

Oxygen Rich Blood returns from the lungs via the Rt. and Lt. pulmonary veins – only veins that carry oxygenated blood

Blood in the Lt. atria is forced through mitral valve into Lt. ventricle

Lt. ventricle contracts forcing the blood through aortic semilunar valve into aorta and continues to systemic circulation

Remember, however, that both of the atrias contract together and both of the ventricles contract together. Atria are filling chambers that contract at the end of diastole to help fill the ventricles leading to a P wave on the EKG.

Conduction system Intrinsic pathway

SA node- (sinoatrial), pacemaker of the heart, paces 60-100 beats/min, triggers impulse that travels from Rt. Atria throughout Lt. Atria and stimulates contraction of the Atria

The impulse travels to AV node (atrio-ventricular) pacemaker of the ventricles, paces 40-60 beats/min, located in inferior portion of intratrial septum The impulse then travels to the Bundle of His, located in the top of the intraventricular septum, down both sides of the septum, to the Rt. and Lt. Bundle branches stimulating the Purkinje fibers causing ventricular contraction. The ventricular contraction or depolarization leads to the QRS on the EKG.

EKG /EKG

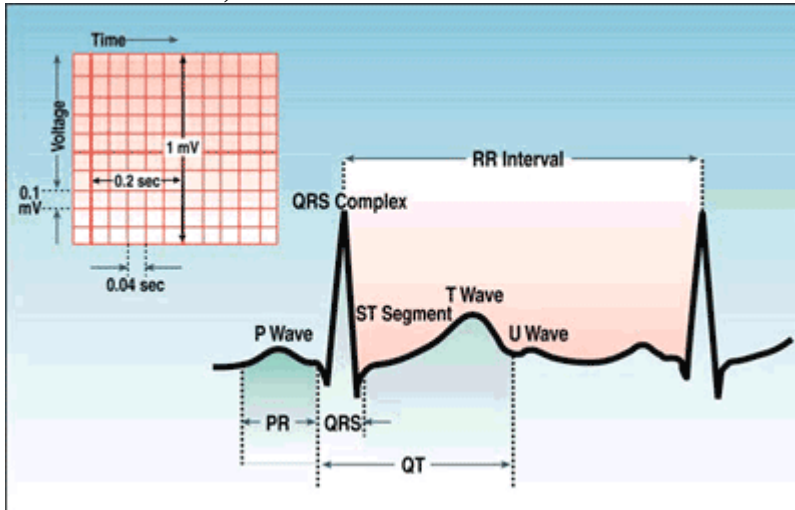
P wave-indicates atrial depolarization (contraction)

QRS-ventricular depolarization (contraction)

T wave-ventricular repolarization (ventricles returning to resting state)

PR interval (time it takes impulse to travel from SA to AV node) should be < .20 seconds=1 large box on EKG paper

QRS interval (time it takes impulse to leave AV and conduct through the ventricular wall) should be < 0.12 seconds=3 small boxes on EKG



CARDIAC OUTPUT = STROKE VOLUME X HEART RATE

BLOOD PRESSURE = CARDIAC OUTPUT X RESISTANCE

PRELOAD= amount of blood volume inside ventricle leading to ventricular stretch prior to ventricular contraction

STROKE VOLUME = Amount of blood ejected with each heart beat

HEART RATE = how fast / beats per minute

RESISTANCE = how far x diameter of the pipes or vessels. Dilated arteries cause less resistance to ventricular ejection and constricted vessels lead to ↑resistance to ventricular ejection of the stroke volume. More thick or viscous blood travels slower and leads to increased resistance making the heart work harder.

AFTERLOAD = Resistance or pressure the ventricles must overcome in order to eject the stroke volume. ↑ afterload/vasoconstriction causes ventricle to work harder, ↓ afterload /vasodilation leads to less work load and therefore ↓ oxygen consumption of the myocardium.

Angina Pectoris: clinical syndrome of pain or a feeling of pressure in the anterior chest often related to obstruction of major coronary arteries leading to myocardial ischemia.

Factors producing pain: physical exertion, exposure to cold- vasoconstriction, eating heavy meal, things which decrease available blood to heart, and/or increase in stress leading to release of stress hormone (epinephrine) from the adrenal gland causing vasoconstriction=↑BP, ↑ heart rate and force of contraction and therefore ↑ MVO₂ (myocardial oxygen consumption)

Characteristics: pain-varying in severity from minor pressure to agonizing pain with apprehension and fear, pain may radiate to neck, jaw, and shoulders. Pain subsides when precipitating cause is removed or after taking medication such as nitroglycerin, which vasodilates the coronary arteries.

Stable Angina- Narrowing of the coronary arteries - pain is predictable, brought on due to stress and or exercise.

Unstable Angina- Narrowing of the coronary arteries - pain is unpredictable may happen with increase of stress but also may happen at rest

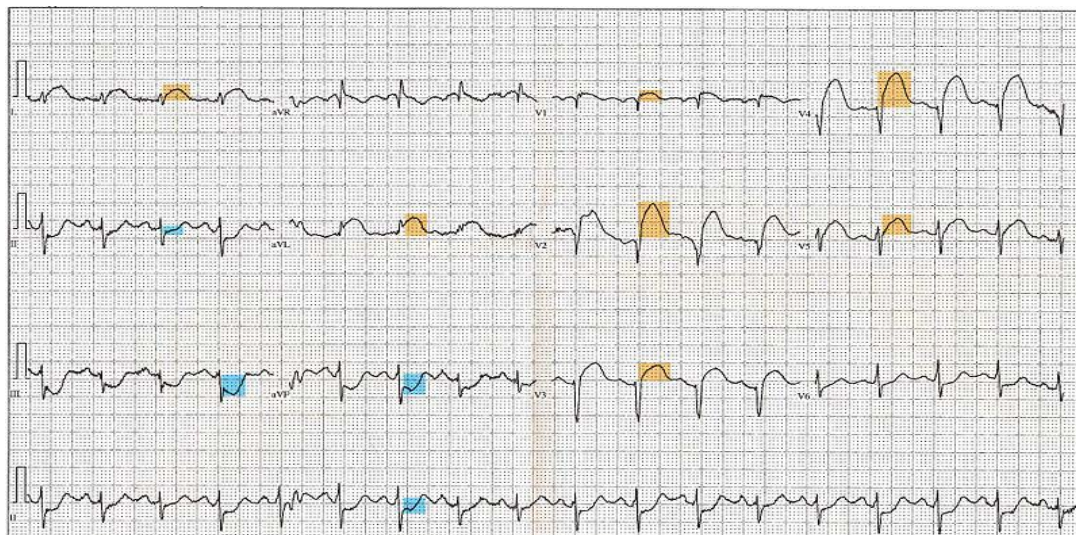
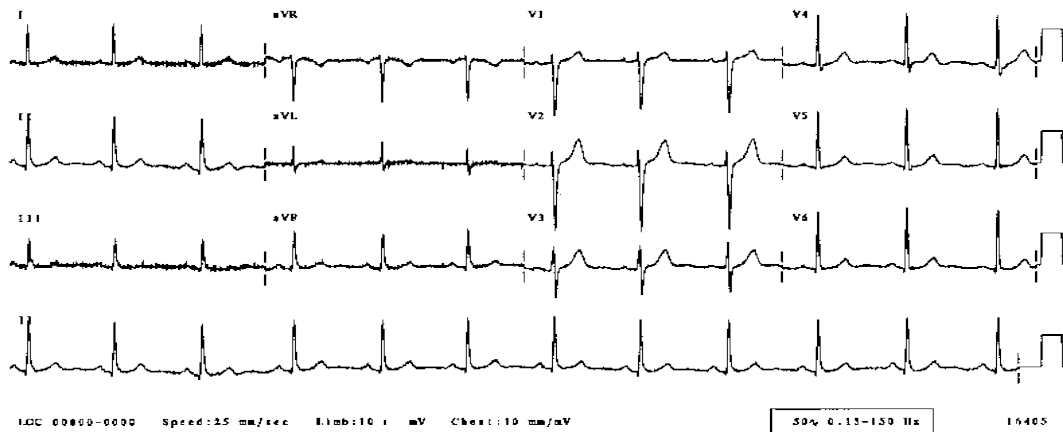
Prinzmetal Angina- Vasospasm of the coronary arteries pain is unpredictable often happening at rest or during sleep; cause is unknown but may be linked with the sympathetic nervous system, calcium or hormone changes causing vasospasms of coronary arteries.

Ischemia → Injury → Infarction

Ischemia =ST depression and/or T wave inversion

Injury=ST elevation

Infarct= pathological Q wave (wide and deep)



Myocardial Infarction:

Cardiac cell destruction/death due to reduced or complete loss of blood supply depleting the oxygen to the myocardium. Once cardiac tissue has died it is replaced with scar tissue and the heart as a unit is compromised. This infarcted tissue can no longer contract or conduct electrical impulses. Changes in 12 lead ECG reading and lab values will be seen within seconds after onset. Permanent damage does not occur until the cells have been denied O₂ for 20 mins.

Causes: arteriosclerosis, or occlusion from embolus or a thrombus.

Characteristics:

Pain: Radiating to the left shoulder and arm but may also be in the face, jaw and middle of the back. Chest pain/Heavy or crushing sensation, may not really be painful but frightening. It also has sudden onset + increase in severity and persists for longer periods, not relieved by rest or nitroglycerin. May also experience N/V, diaphoresis. Diabetics often exhibit non-classic signs/symptoms.

Pulse: Rapid, irregular, weak

Cardiac Output and BP: Initially ↑ R/T sympathetic nervous stimulation but will drop as damage continues. Oxygen deprived myocardial tissues are more prone to causing arrhythmias even life threatening (ventricular tachycardia/fibrillation)

GI System: Vasovagal stimulation caused by ↑ leading to syncope causes nausea, pallor and perspiration (diaphoresis)

Catecholamines (Epi & NE): released by the adrenal gland secondary to decreased renal perfusion leads to increased heart rate, peripheral vasoconstriction, and increased blood glucose levels

Lab results

Increases in: WBC's, sedimentation rates, temperature and blood glucose (may stay high for weeks),

Enzymes:

Cardiac troponin T (cTnT) increases 3-6 hrs. remains elevated 14-21 days

Cardiac troponin I (cTnI) increases 7-14 hrs. remains elevated 5-7 days

CK-MB: CK isoenzyme elevates 4-6 hrs. peaks within 24 hrs. normal within 72hrs

Myoglobin increases earlier than the CK and is indicative of an MI

LDH-1 & LDH-2: elevates 4 hrs. peaks within 48 hrs.

SGOT (AST): elevates days 2-4

Tests

Cardiac Nuclear Scanning (thallium) shows underperfused areas leading to dyskinesia (abnormal wall motion). Echocardiographic studies reveal wall motion and calculate ejection fractions (the amount ejected should be 55% or greater than the ventricular volume preload= the amount of blood in the ventricle prior to contraction) Coronary angiography determines patency of coronary blood vessels and identifies arteries amenable to PTCA-percutaneous transluminal coronary angioplasty vs. need for CABG-coronary artery bypass graft.

Congestive Heart Failure (CHF)

Left side – Weakened left ventricle is unable to adequately pump the oxygenated blood out to the body. The blood backs up in the left atrium, then the Pulmonary veins and lungs. Increased pressure in the heart and the lung causes fluid to be forced into pulmonary tissues leading to pulmonary edema. The end result is a decreased area of gas exchange.

Characteristics: cough, pink frothy sputum, shortness of breath, fatigue, tachycardia, anxiety, restlessness, and fluid in the lungs = crackles.

Rt. sided failure: Right Ventricle is unable to pump well leading to back up into the Vena Cava and congestion in the viscera and peripheral tissues predominates.

Characteristics: dependent edema, periorbital edema, weight gain, jugular venous distention (JVD) = distended neck veins, ascities, anorexia, nausea, weakness,

Note: Left sided heart failure will often develop into right sided as the heart begins to wear out and blood continues to back up. Right sided failure may lead to left sided due to decreased pumping leading to decreased preload-stroke volume-cardiac output and therefore coronary perfusion.

Peripheral Arterial Disease

Progressive narrowing and degeneration of the arteries, most often caused by atherosclerosis. This will lead to ischemia in an extremity causing delayed wound healing which can lead to ulceration or even gangrene

Characteristics:

- Intermittent claudication or pain in the extremity upon walking
- Extremity will become reddish when in a dependent position
- Upon elevation the extremity will blanch
- Loss of hair
- Presence of ulcers, or gangrene
- Diminished or absent pulses
- Remember 6 P's of arterial insufficiency
- Pulse (weak or absent), Pallor, Pain, Paresthesia, Paralysis, Poikothermia

Deep Vein Thrombosis DVT

A blood clot forms in a vein in the systemic circulation often associated with prolonged immobility, usually located in the legs

Risk factors:

CHF, MI, prolonged bed rest or traction, obesity, dehydration, venous insufficiency, surgery, leg trauma, pregnancy and advanced age

Characteristics:

- May be asymptomatic
- Swelling of the extremity often unilateral if bilateral look to the inferior vena cava
- Localized area will be warm, red and swollen
- Pain and tenderness at the site of the clot-Positive Homan's sign-pain when dorsiflexing foot

Remember : Clots in the legs Go to the lungs → Pulmonary Emboli or to the brain →CVA