Auscultation of the heart. New methods for examining the cardiovascular system

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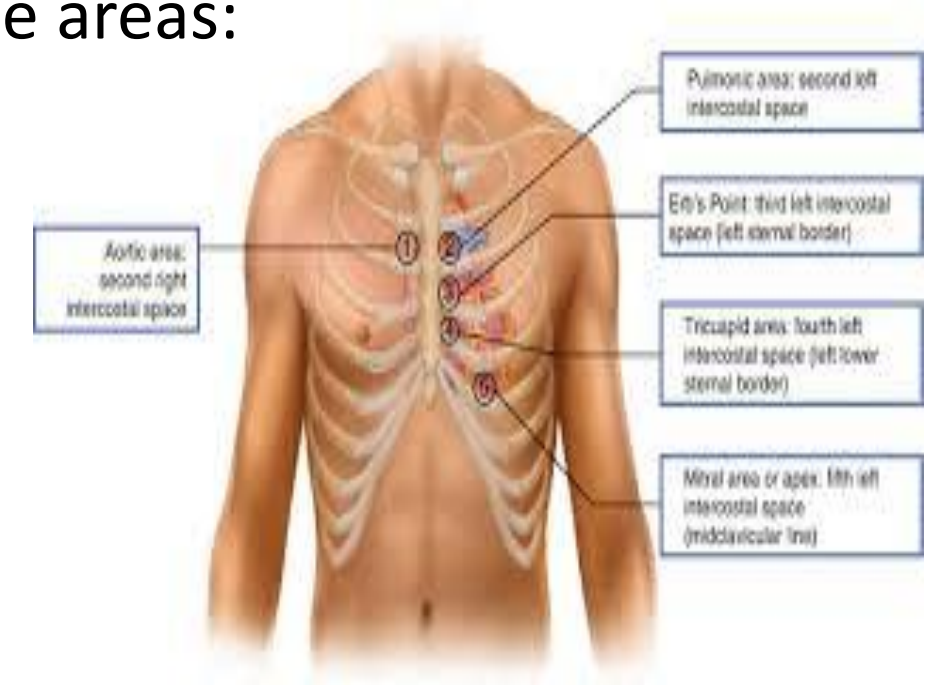
What is auscultation?

- Auscultation is the medical term for using a stethoscope to listen to the sounds inside of your body. This simple test poses no risks or side effects.
- **Why is auscultation used?**
- Abnormal sounds may indicate problems in these areas:
- Lungs, heart, major blood vessels

Potential issues can include: irregular heart rate



How is the test performed?

Doctor places the stethoscope over skin and listens to each area of your body. There are specific things your doctor will listen for in each area.

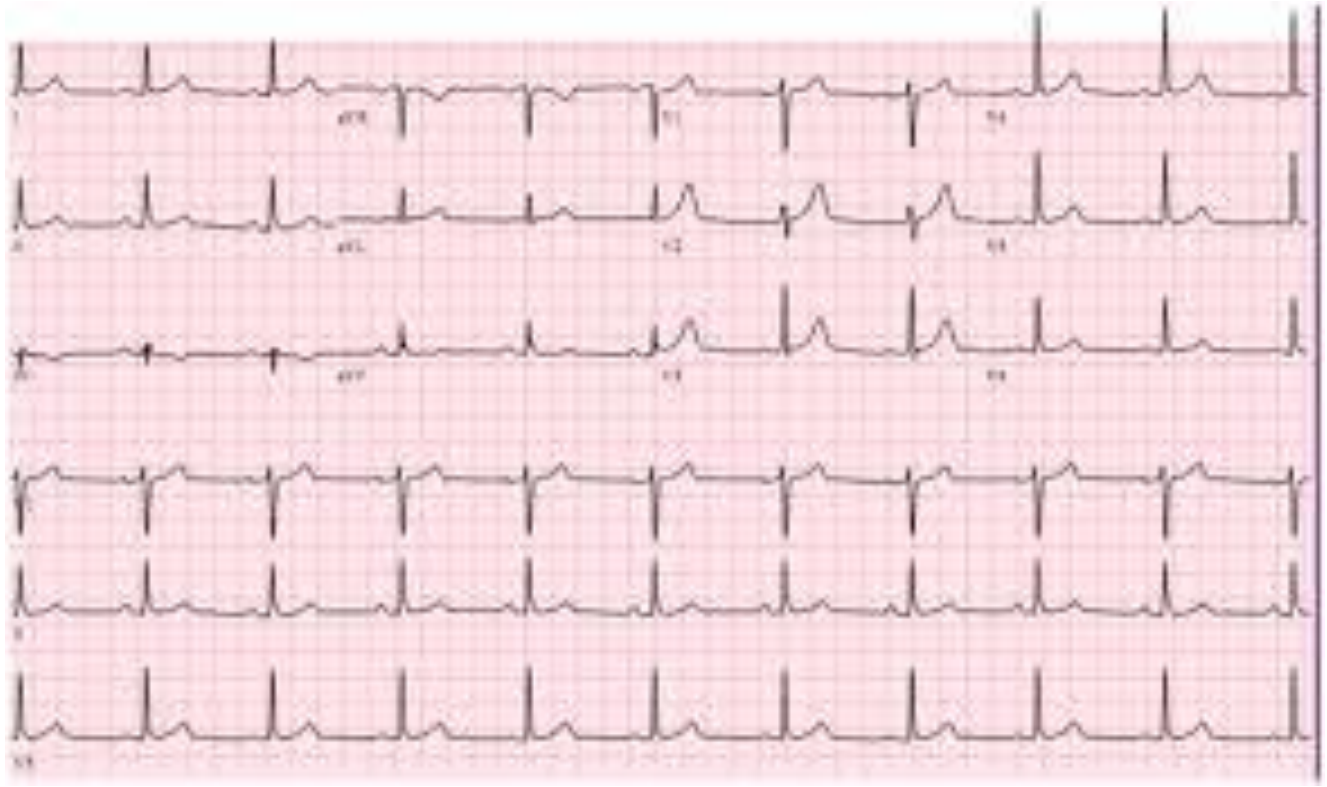
- Heart: To hear your heart, your doctor listens to the four main regions where heart valve sounds are the loudest. These are areas of your chest above and slightly below your left breast. Some heart sounds are also best heard when you're turned toward your left side. In your heart, your doctor listens for:

- what your heart sounds like
- how often each sound occurs
- how loud the sound is

How are results interpreted?

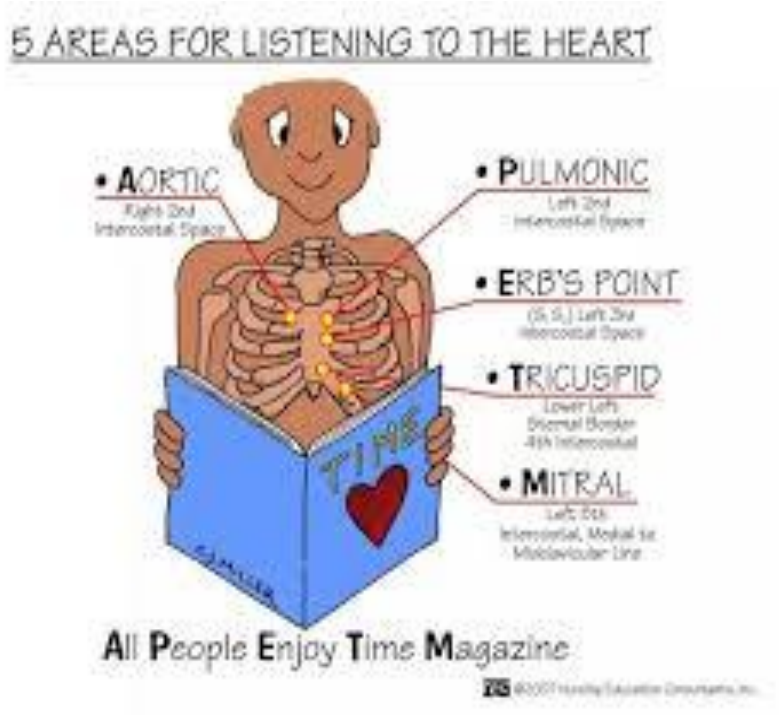
Heart

- Traditional heart sounds are rhythmic. Variations can signal to your doctor that some areas may not be getting enough blood or that you have a leaky valve. Your doctor may order additional testing if they hear something unusual.



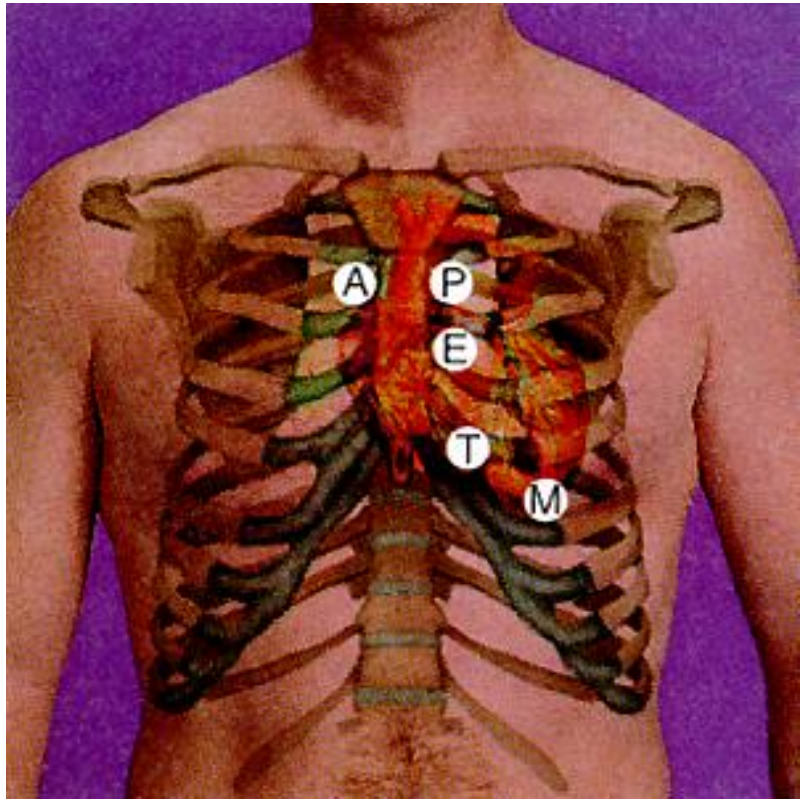
Specific Areas of the Cardiovascular Assessment

- **Auscultation of the chest using the diaphragm and bell in various positions to include the following locations**
  - **Aortic area at the right second intercostal space–S_2 is louder than S_1**
  - **Pulmonic area at the left second intercostal space–S_2 is louder than S_1**
  - **Erb's point at the left third intercostal space–S_1 and S_2 are heard equally**



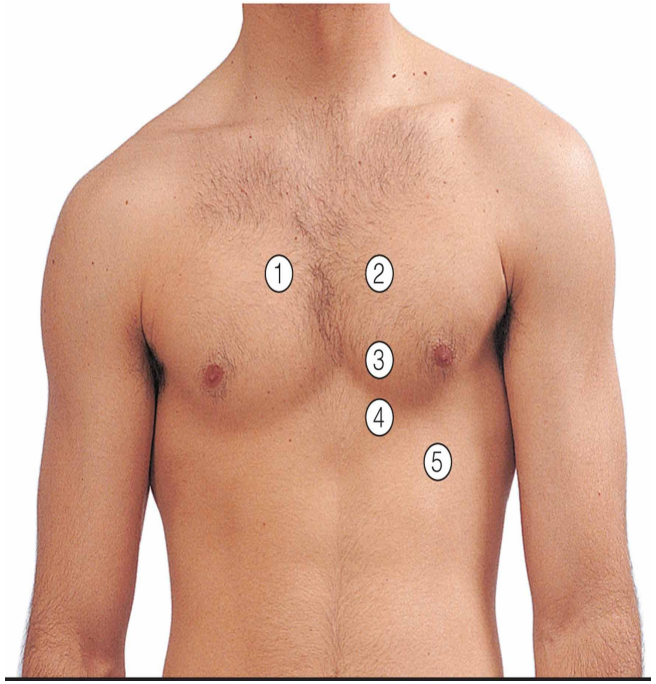
Specific Areas of the Cardiovascular Assessment

- **Auscultation of the chest using the diaphragm and bell in various positions to include the following locations**
  - **Tricuspid area at the left fourth intercostal space–S_1 is louder than S_2**
  - **Apex at the left fifth intercostal space at the midclavicular line–S_1 is louder than S_2**



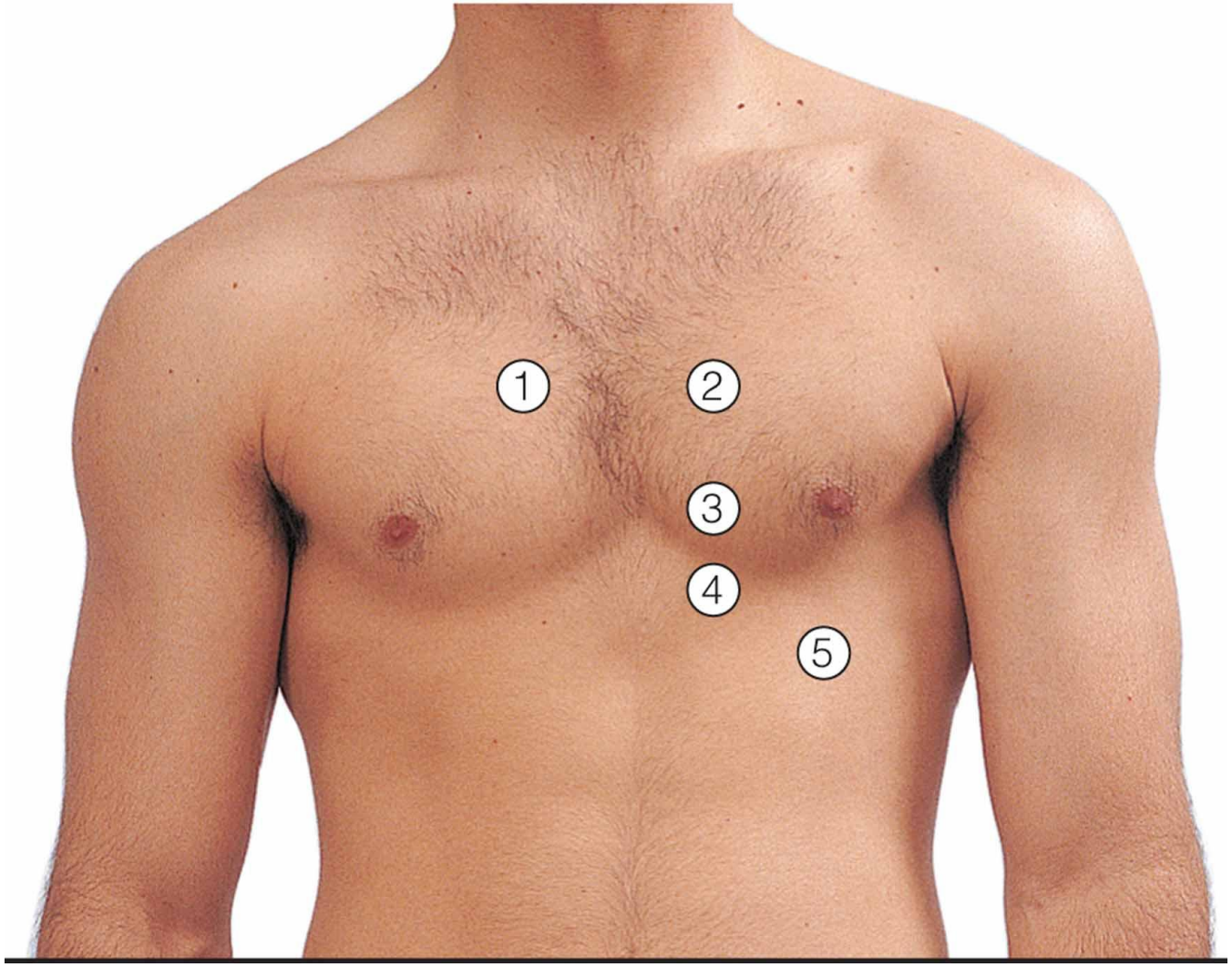
Auscultation

- **Listen in all 5 listening areas for S1 and S2 using the diaphragm of the stethoscope**
- **Then listen at the apex with the bell**
- **The diaphragm and the bell ...**
- **The diaphragm is best for detecting high-pitched sounds like S1, S2, and also S4 and most murmurs**
- **The bell is best for detecting low-pitched sounds like S3 and the rumble of mitral stenosis**



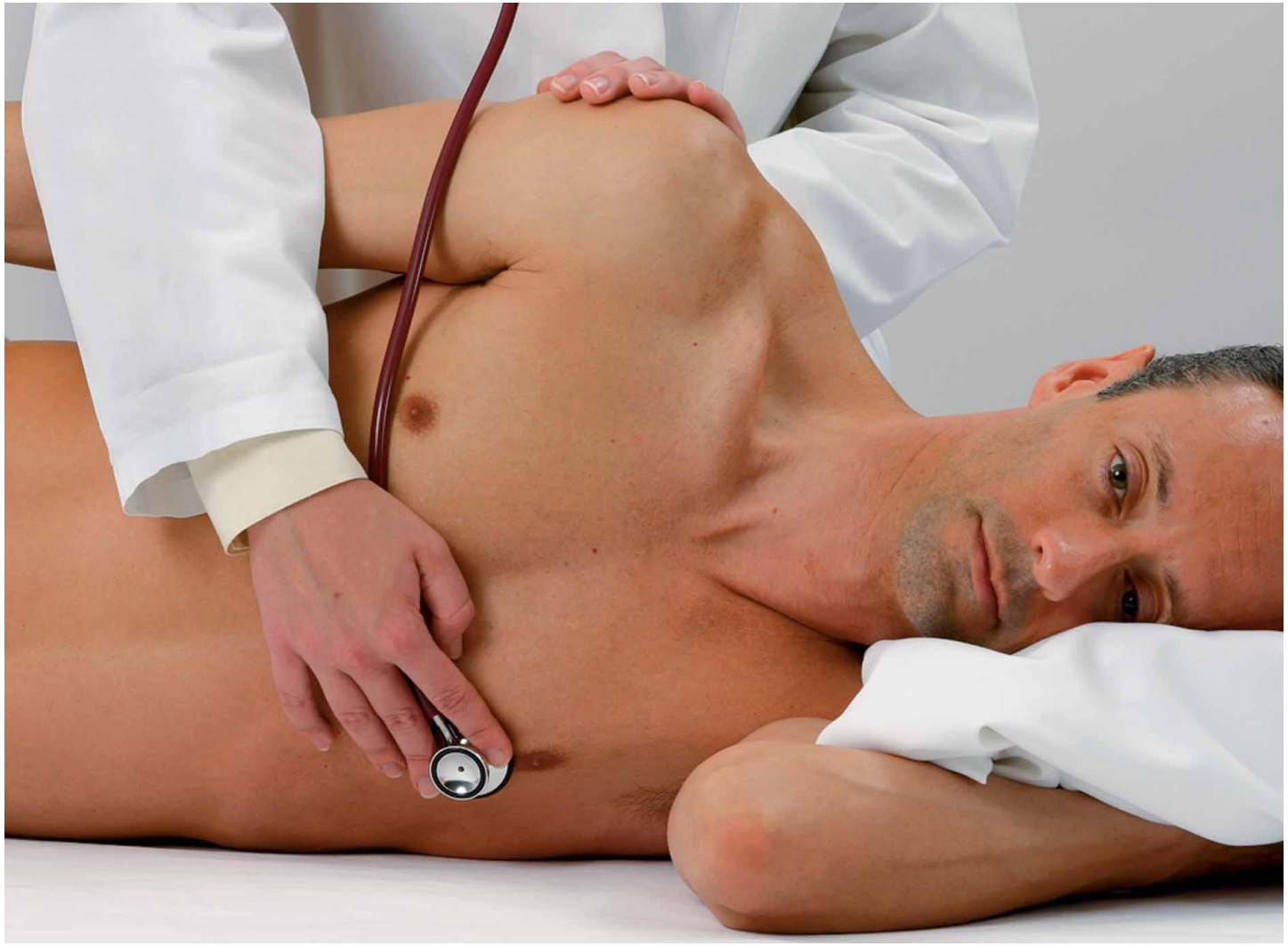
Auscultating the chest over five key landmarks.

Auscultating the chest over five key landmarks.

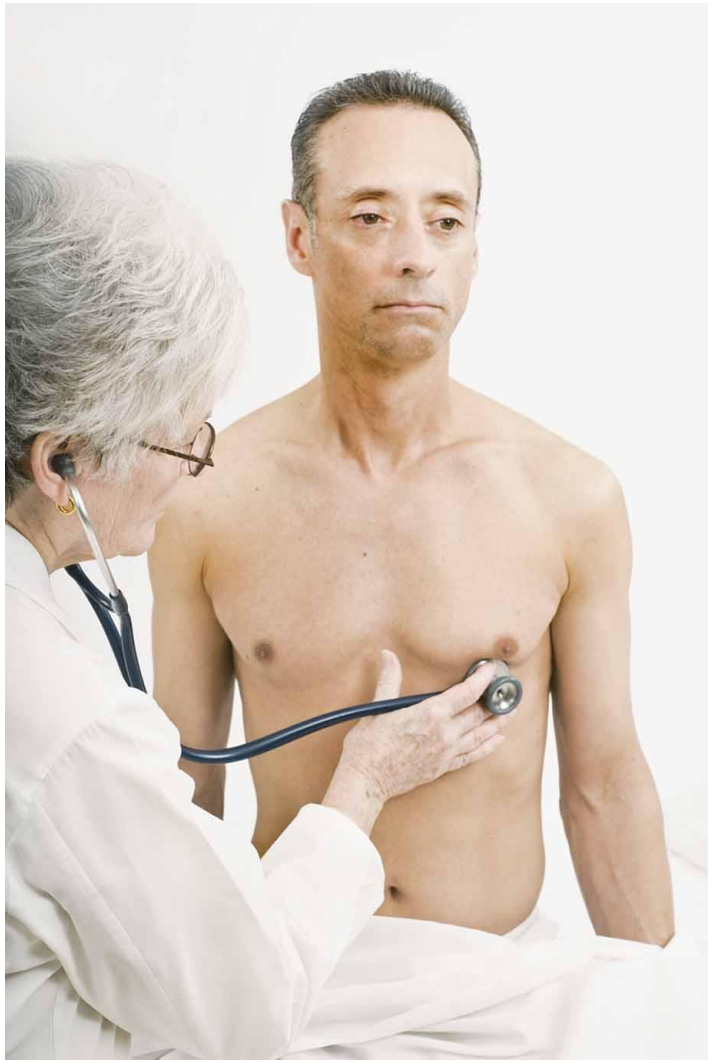


Positions for auscultation of the heart. **A**. Supine.

(continued) Positions for auscultation of the heart. **B**. Lateral.



(continued) Positions for auscultation of the heart. **C**. Sitting.



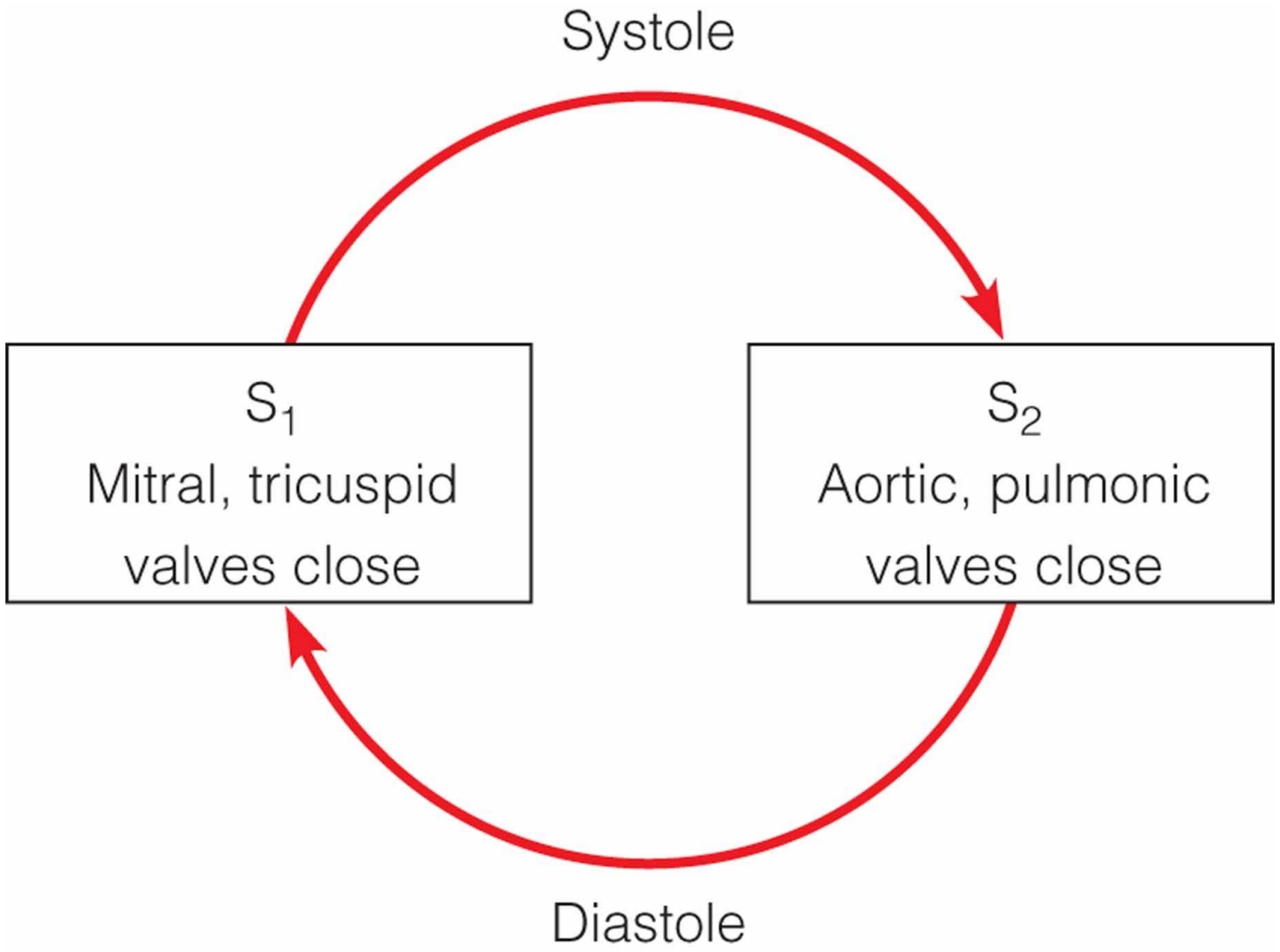
Heart Sounds

S_1 The first heart sound, or S1, forms the "lub" of "lub-dub" and is composed of components M1 (mitral valve closure) and T1 (tricuspid valve closure). Normally M1 precedes T1 slightly. It is caused by the closure of the atrioventricular valves, i.e. tricuspid and mitral (bicuspid), at the beginning of ventricular contraction, or systole.

S_2 The second heart sound, or S2, forms the "dub" of "lub-dub" and is composed of components A2 (aortic valve closure) and P2 (pulmonary valve closure). Normally A2 precedes P2 especially during inspiration where a split of S2 can be heard. It is caused by the closure of the semilunar valves (the aortic valve and pulmonary valve) at the end of ventricular systole and the beginning of ventricular diastole. As the left ventricle empties, its pressure falls below the pressure in the aorta.

These are the first heart sound (S1) and second heart sound (S2), produced by the closing of the atrioventricular valves and semilunar valves, respectively. In addition to these normal sounds, a variety of other sounds may be present including heart murmurs, adventitious sounds, and gallop rhythms S3 and S4.

Heart sounds in systole and diastole.



Q: Can I perform auscultation on myself at home? If so, what are the best ways to do this effectively and accurately?

- A: In general, auscultation should only be done by a trained medical professional, such as a doctor, nurse, EMT, or medic. The reason for this is because the nuances of performing an accurate stethoscope auscultation are quite complicated. When listening to the heart, lungs, or stomach, the untrained ear would not be able to differentiate between healthy, normal sounds versus sounds that may indicate a problem.

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Table 17.1 Characteristics of Heart Sounds

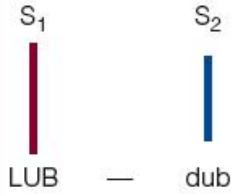
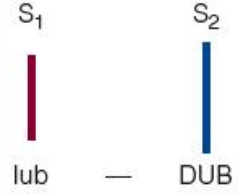
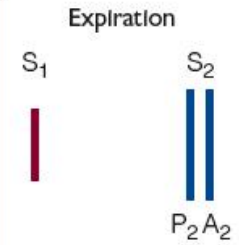
HEART SOUNDS	CARDIAC CYCLE TIMING	AUSCULTATION SITE	POSITION	PITCH
 S1	Start of systole	Best at apex with diaphragm	Position does not affect the sound	High
 S2	End of systole	Both at 2nd ICS; pulmonary component best at LSB; aortic component best at RSB with diaphragm	Sitting or supine	High
 Split S1	Beginning of systole	If normal, at 2nd ICS, LSB; abnormal if heard at apex	Better heard in the supine position	High
 Fixed Split S2	End of systole	Both at 2nd ICS; pulmonary component best at LSB; aortic component best at RSB with diaphragm	Better heard in the supine position	High
 Paradoxical Split S2	End of systole	Both at 2nd ICS; pulmonary component best at LSB; aortic component best at RSB with diaphragm	Better heard in the supine position	High

Table 17.3 Distinguishing Heart Murmurs

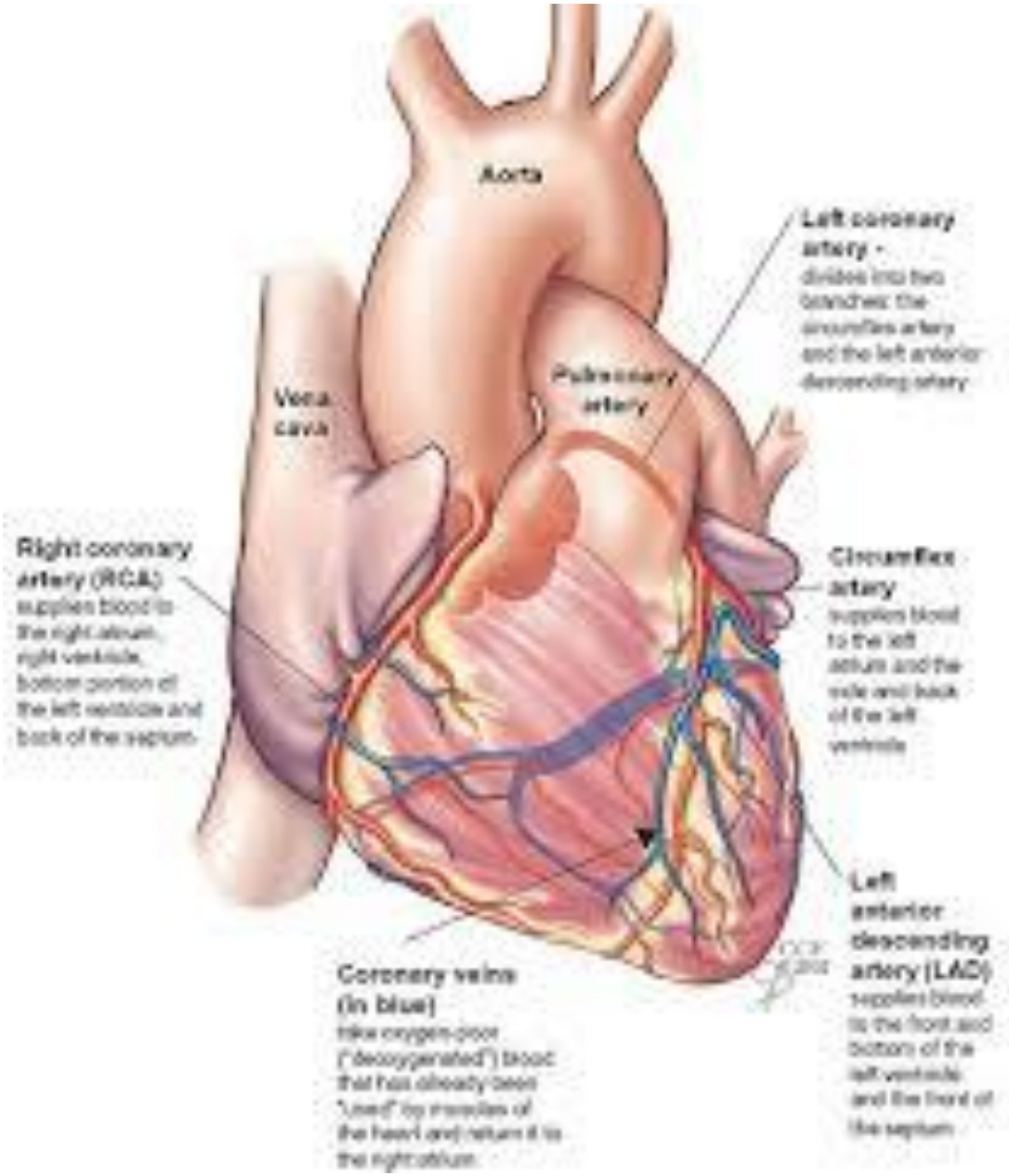
ASK YOURSELF	INFORMATION
1. How loud is the murmur?	Murmurs are graded on a rather subjective scale of 1–6: • Grade 1: Barely audible with stethoscope, often considered physiologic not pathologic. Requires concentration and a quiet environment. • Grade 2: Very soft but distinctly audible. • Grade 3: Moderately loud; there is no thrill or thrusting motion associated with the murmur. • Grade 4: Distinctly loud, in addition to a palpable thrill. • Grade 5: Very loud, can actually hear with part of the diaphragm of the stethoscope off the chest; palpable thrust and thrill present. • Grade 6: Loudest, can hear with the diaphragm off the chest; visible thrill and thrust.
2. Where does it occur in the cardiac cycle: systole, diastole, or both?	Location in cardiac cycle: • Systole: early systole, midsystole, late systole • Diastole: early diastole, mid-diastole, late diastole • Both
3a. Is the sound continuous throughout systole, diastole, or only heard for part of the cycle?	Duration of murmur: • Continuous through systole only • Continuous through diastole only • Continuous through systole and diastole *Systolic murmurs* may be of two types: • Midsystolic: Murmur is heard after S_1 and stops before S_2. • Pansystolic/holosystolic: Murmur begins with S_1 and stops at S_2. *Diastolic murmurs* may be one of three types: • Early diastolic: Murmur auscultated immediately after S_2 and then stops. There is a gap where this murmur stops and S_1 is heard. • Mid-diastolic: Murmur begins a short time after S_2 and stops well before S_1 is auscultated. • Late diastolic: This murmur starts well after S_2 and stops immediately before S_1 is heard.

Contraction and Relaxation Phases of the Heart

- **Systole**
- **Diastole**

Circulation of the Heart

- **Coronary arteries**
  - **Left main**
  - **Right coronary**
  - **Left anterior descending**
  - **Circumflex**

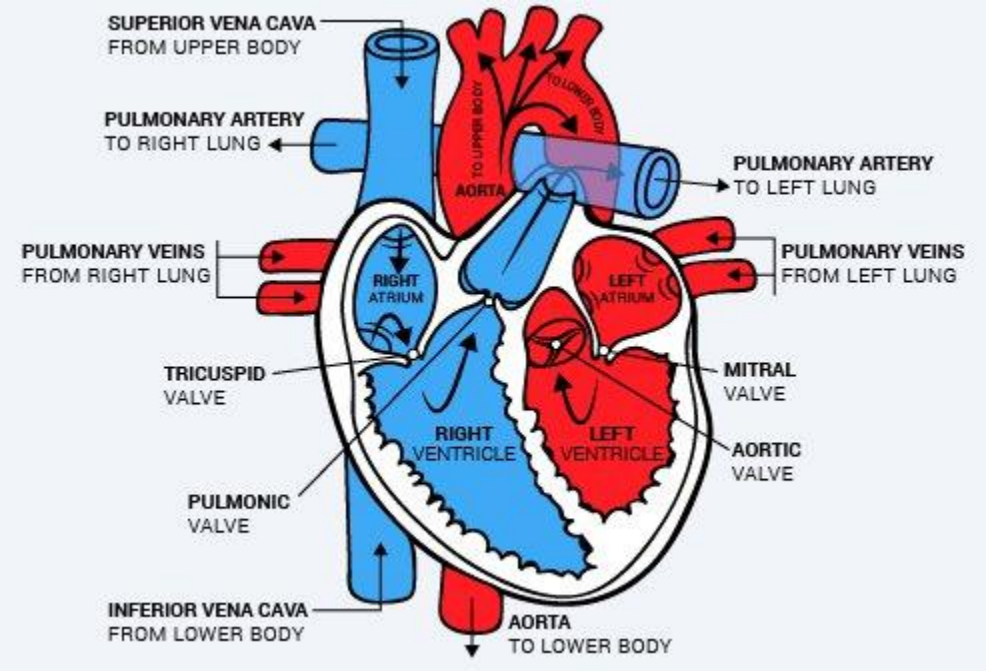


The heart is an amazing organ

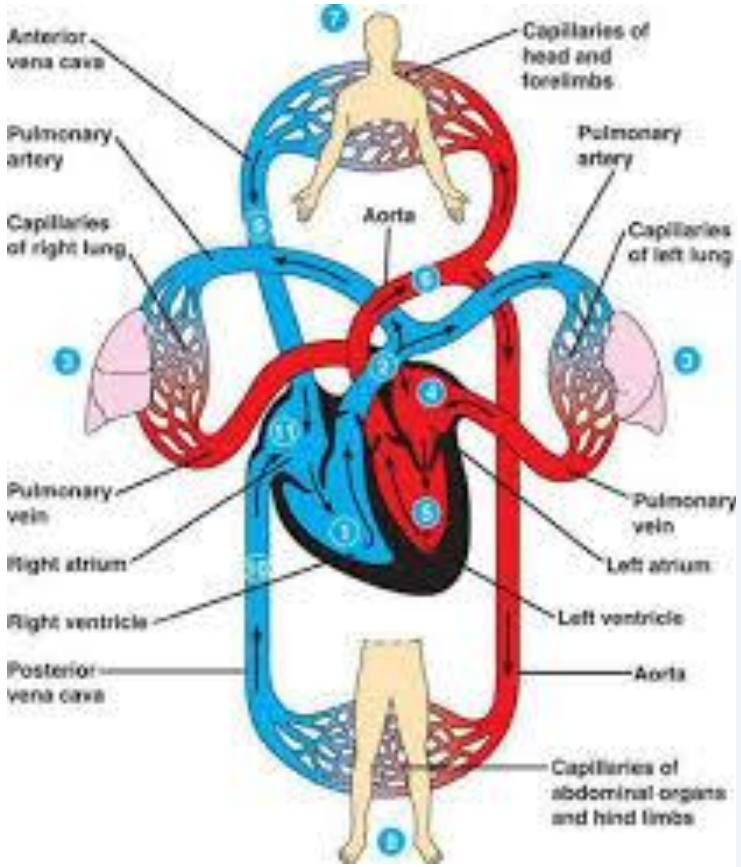
It starts beating about 22 days after conception and continuously pumps oxygenated red blood cells and nutrient-rich blood and other compounds like platelets throughout your body to sustain the life of your organs.

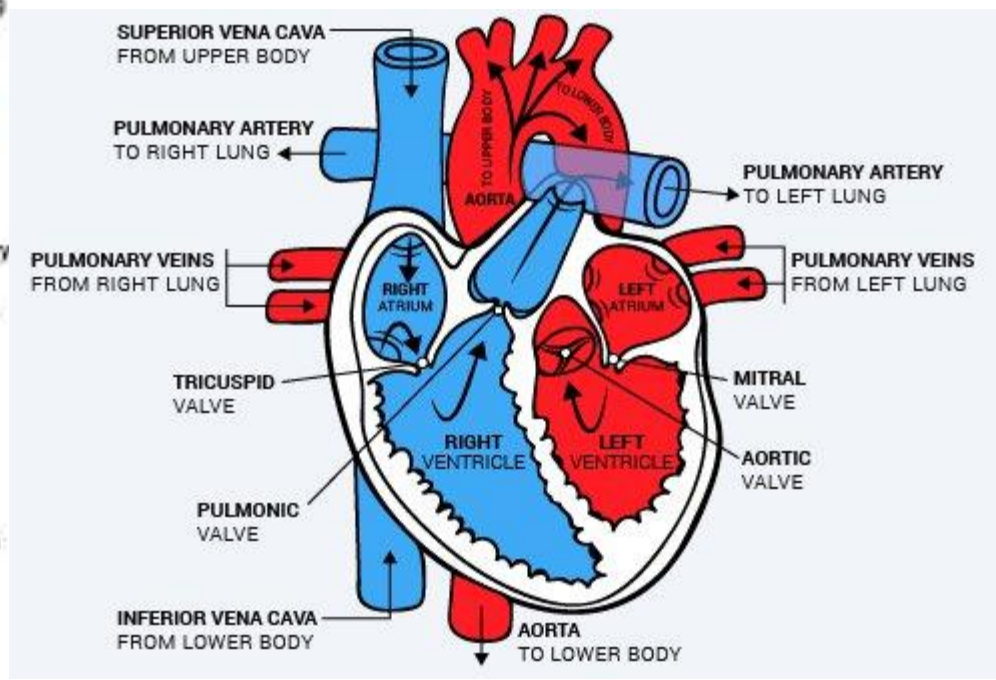
Its pumping power also pushes blood through organs like the lungs to remove waste products like CO2.

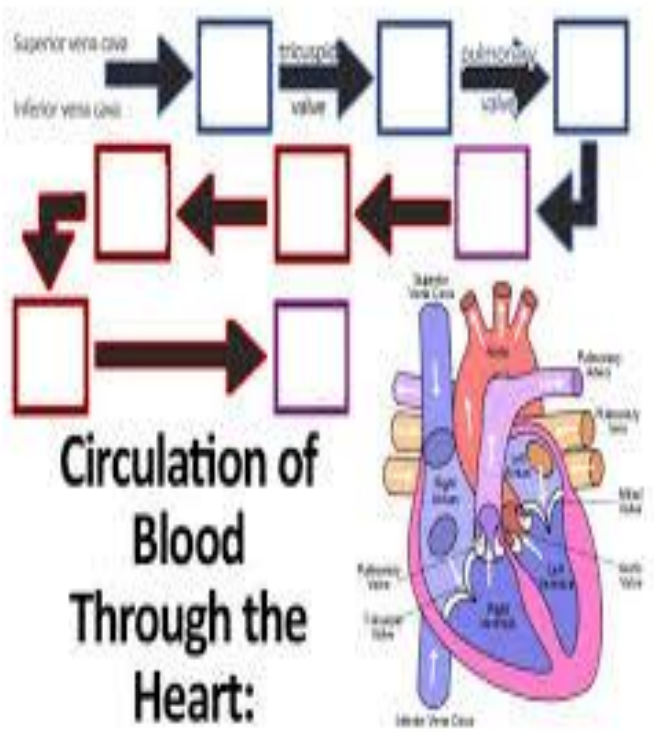
This fist-sized powerhouse beats (expands and contracts) about 100,000 times per day, pumping five or six quarts of blood each minute, or about 2,000 gallons per day.



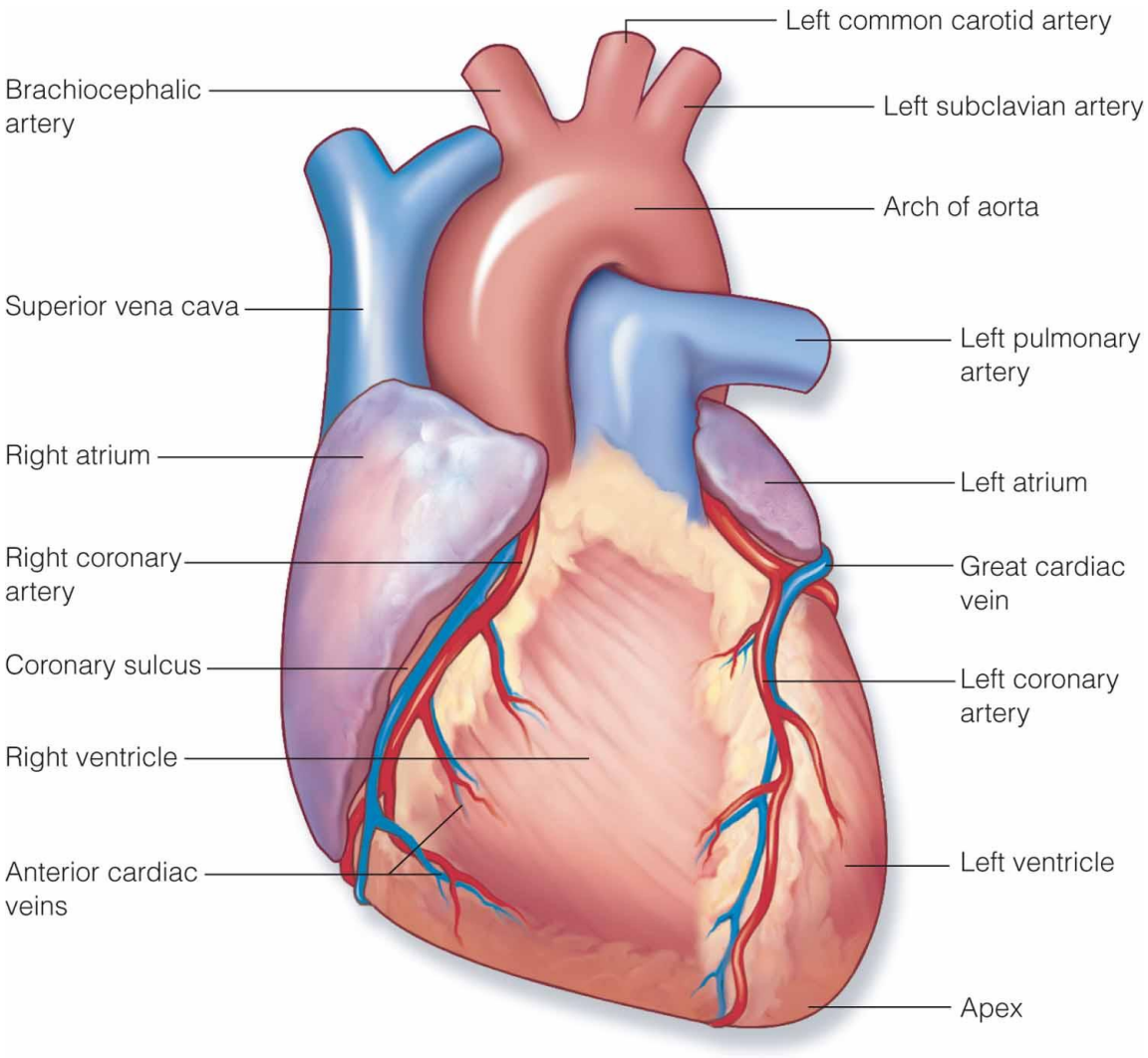
Circulation of the heart





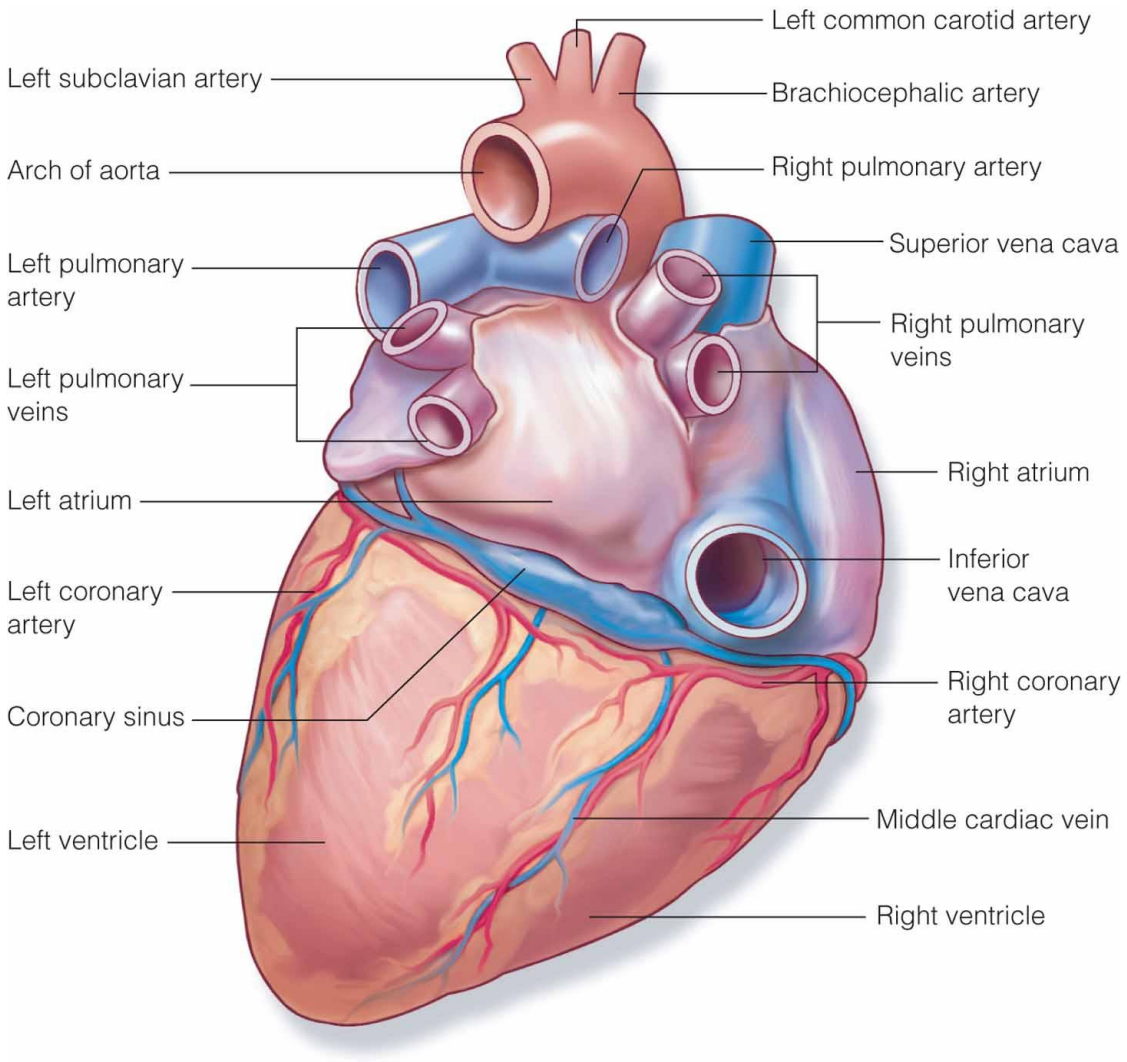


Vessels of the heart. **A**. Anterior.



A

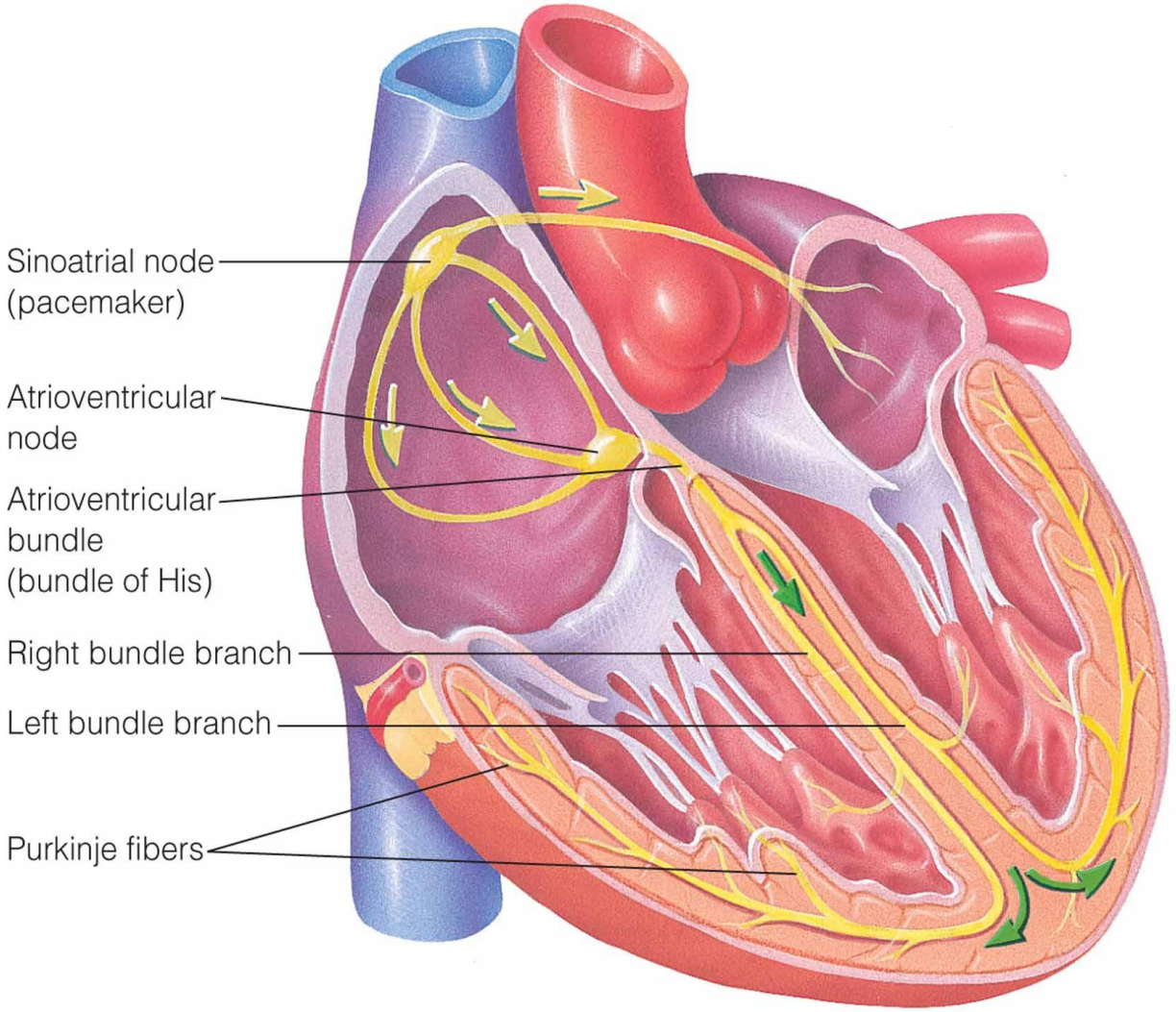
(continued) Vessels of the heart. **B**. Posterior.



B

Conduction System of the Heart

- **Sinoatrial (SA) node**
- **Intra-atrial pathways**
- **AV node**
- **Bundle of His**
- **Right and left bundle branches**
- **Purkinje fibers**

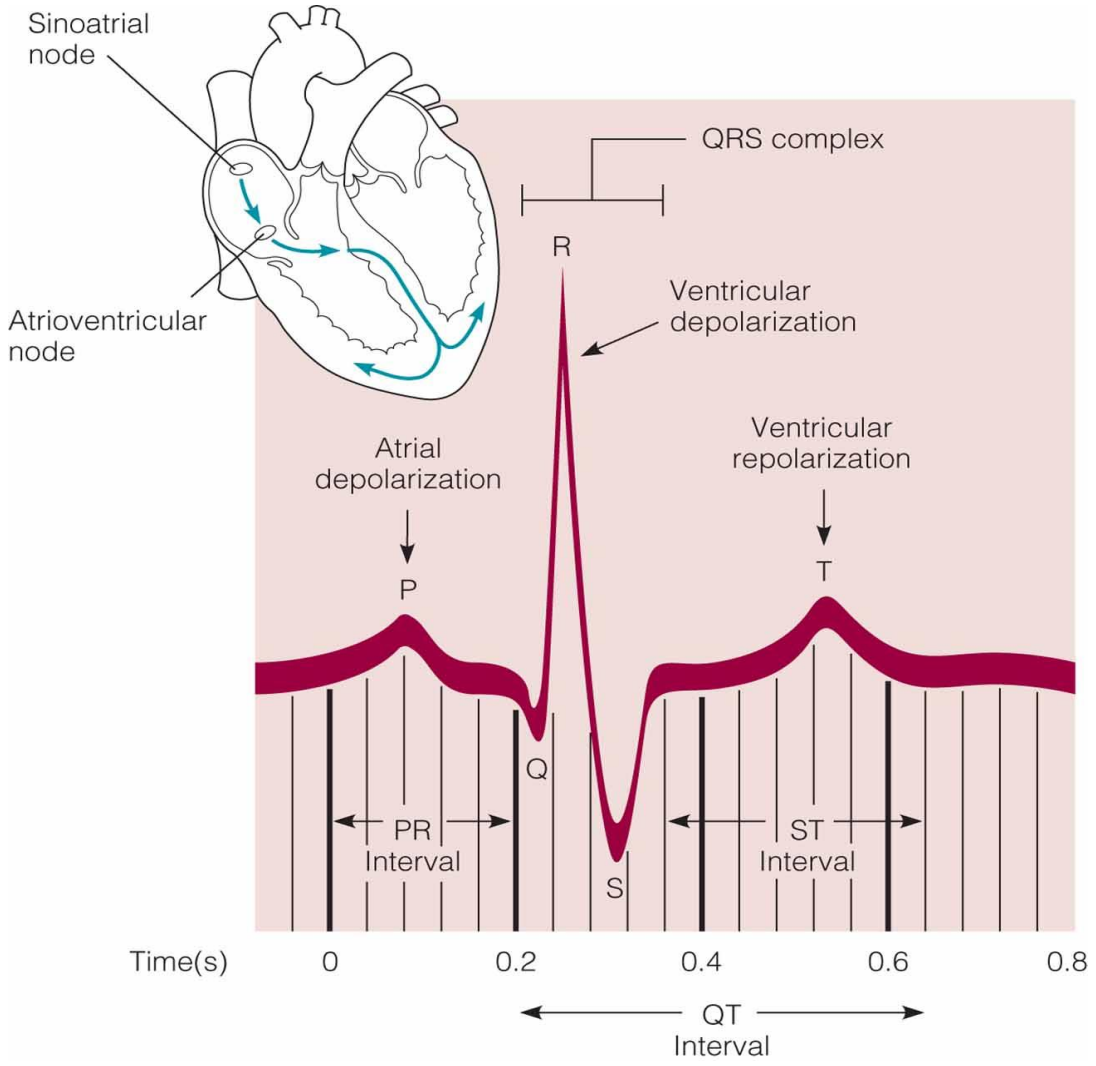


Cardiac Cycle

- Contraction and Relaxation of the Chambers

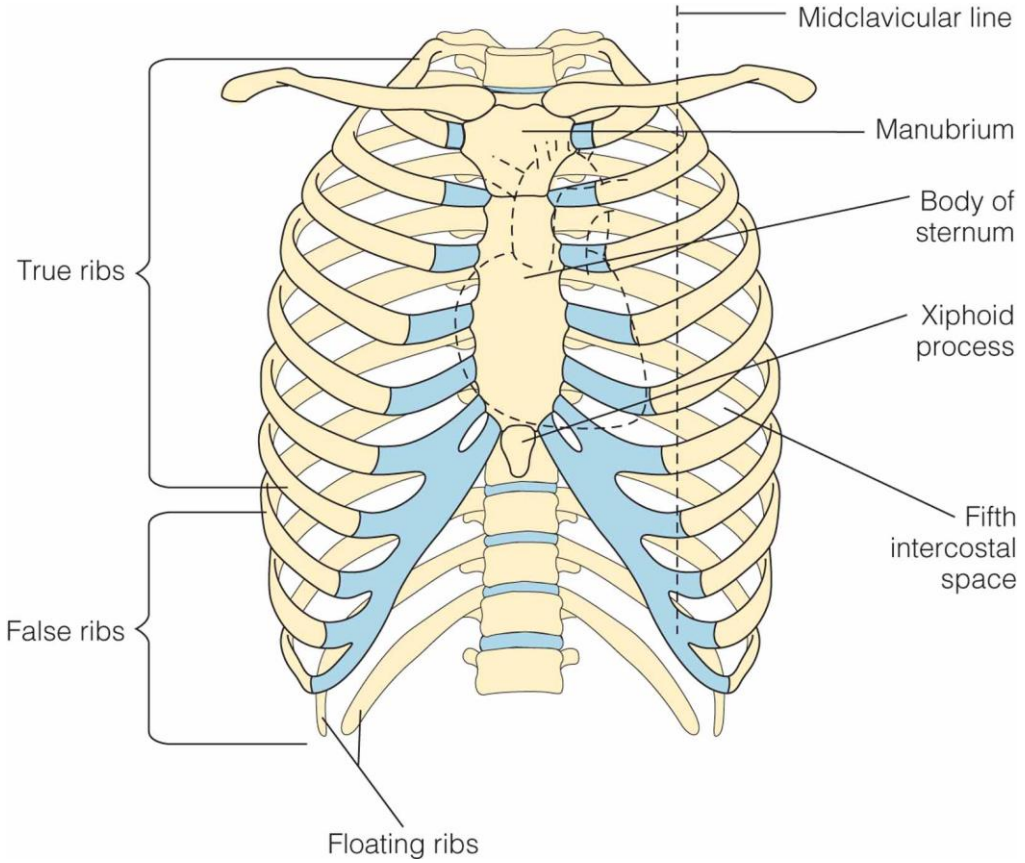
Electrocardiogram (ECG)

- **Paper Recording of Deflections that Represent the Cardiac Cycle**
- **Electrical deflections**
  - ***P* wave**
  - ***PR* interval**
  - ***QRS* interval**
  - ***T* wave**



Landmarks for Cardiac Assessment

- **Sternum**
- **Clavicles**
- **Ribs**
- **Second through fifth intercostal spaces**



Specific Areas of the Cardiovascular Assessment

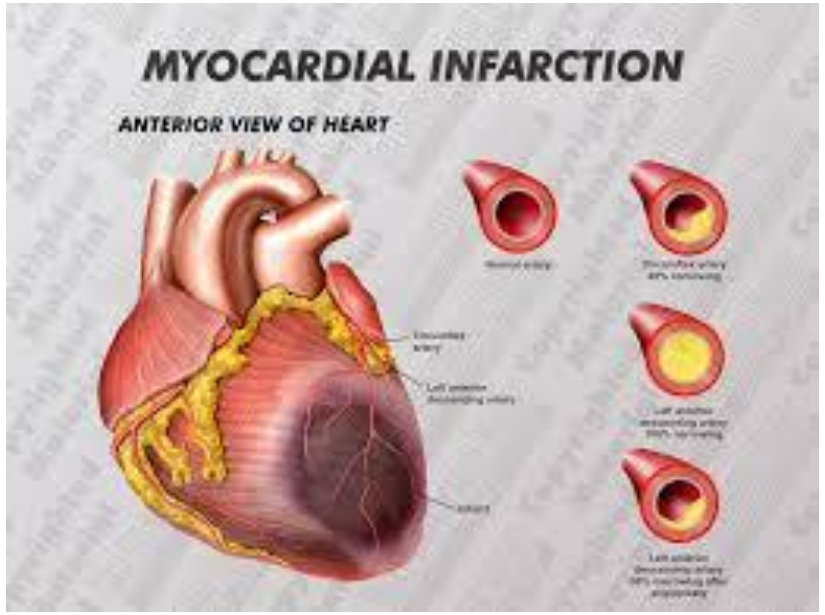
- **Auscultation of the carotid arteries using the diaphragm and bell**
- **Comparison of the apical pulse to a carotid pulse**

Abnormal Findings in the Cardiovascular System

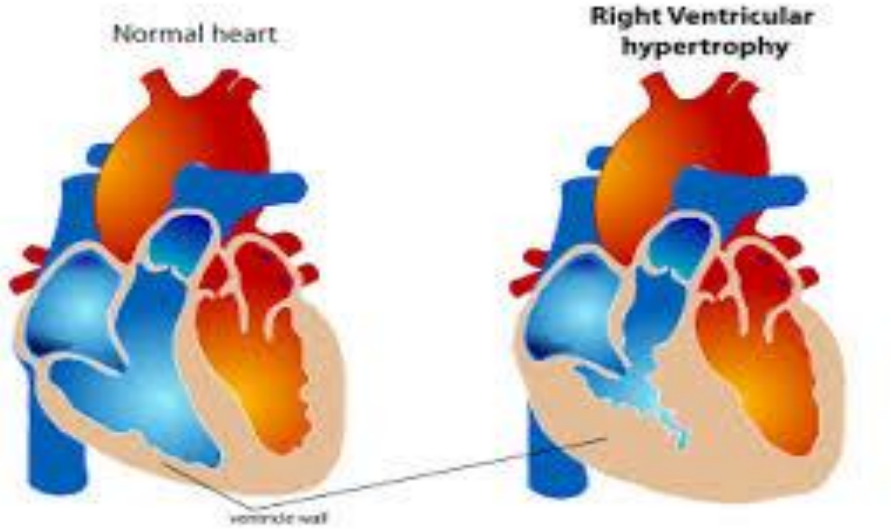
- Myocardial and pump disorders
- Valvular disease
- Septal defects
- Congenital heart disease
- Electrical rhythm disturbances

Myocardial and Pump Disorders

- Myocardial ischemia
- Myocardial infarction
- Congestive heart disease
- Ventricular hypertrophy

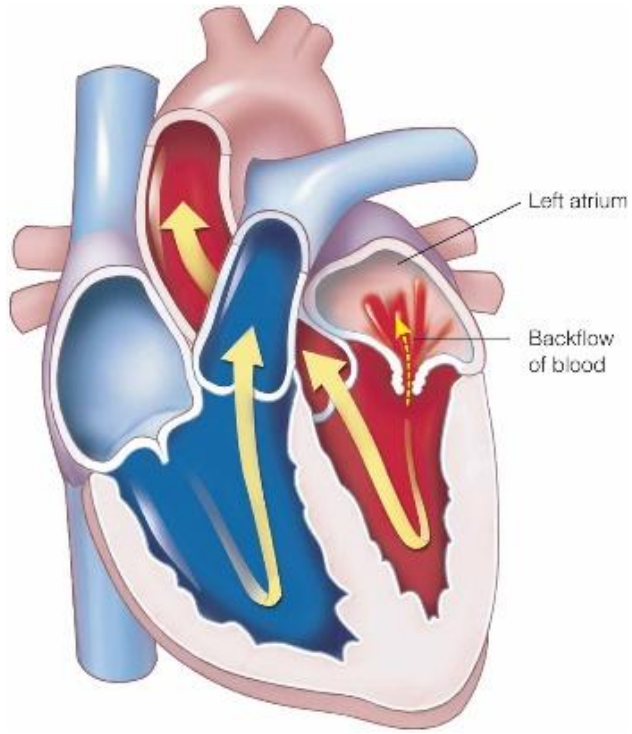


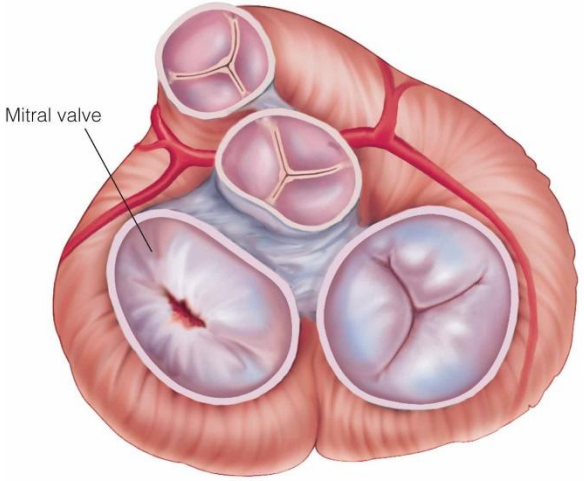
Myocardial infarction (anterior)



Valvular Diseases

- Mitral, aortic, tricuspid, and pulmonic stenosis
- Mitral and aortic regurgitation
- Mitral valve prolapse





Echocardiography of the heart

What is an echocardiogram?

An echocardiogram (echo) is a test that uses high frequency sound waves (ultrasound) to make pictures of your heart.

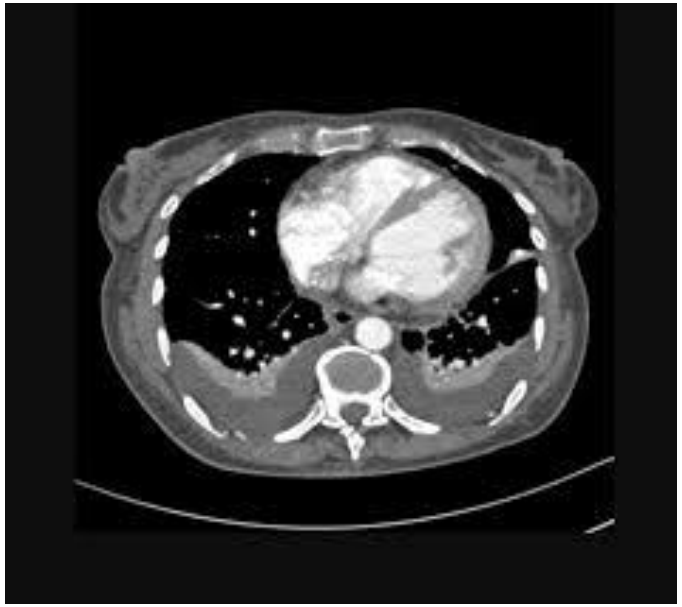
Doppler echocardiography

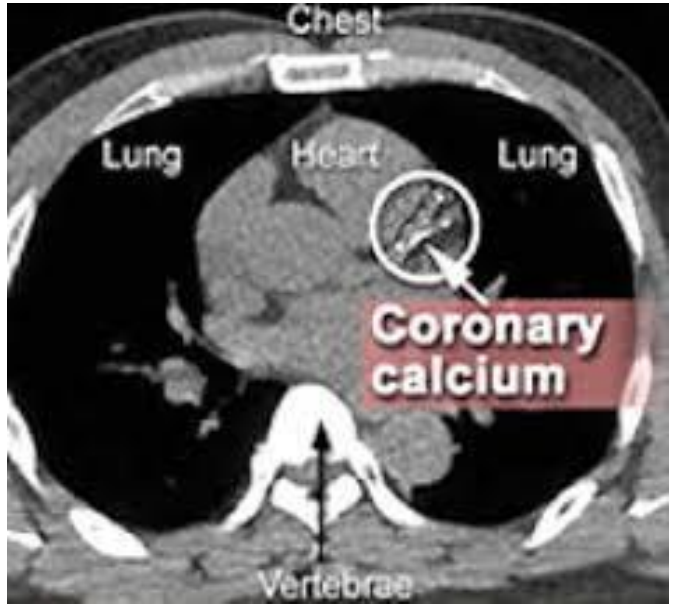
Doppler echocardiography is a procedure that uses Doppler ultrasonography to examine the heart. An echocardiogram uses high frequency sound waves to create an image of the heart while the use of Doppler technology allows determination of the speed and direction of blood flow by utilizing the Doppler effect.

Quick facts EchoCG

- An echo uses sound waves to create pictures of your heart’s chambers, valves, walls and the blood vessels (aorta, arteries, veins) attached to your heart.
- A probe called a transducer is passed over your chest. The probe produces sound waves that bounce off your heart and “echo” back to the probe. These waves are changed into pictures viewed on a video monitor.
- An echo can’t harm you.

CT scan of the heart





What is a heart CT scan?

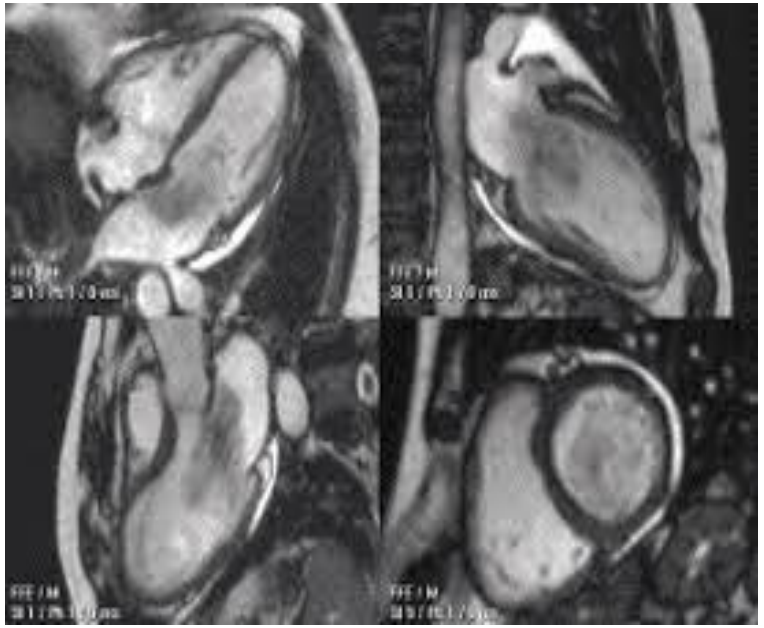
A CT scan uses X-rays to view specific areas of the body. A heart, or cardiac, CT scan is used to view your heart and blood vessels. During the test, a specialized dye is injected into your bloodstream. The dye is then viewed under a special camera in a hospital or testing facility.

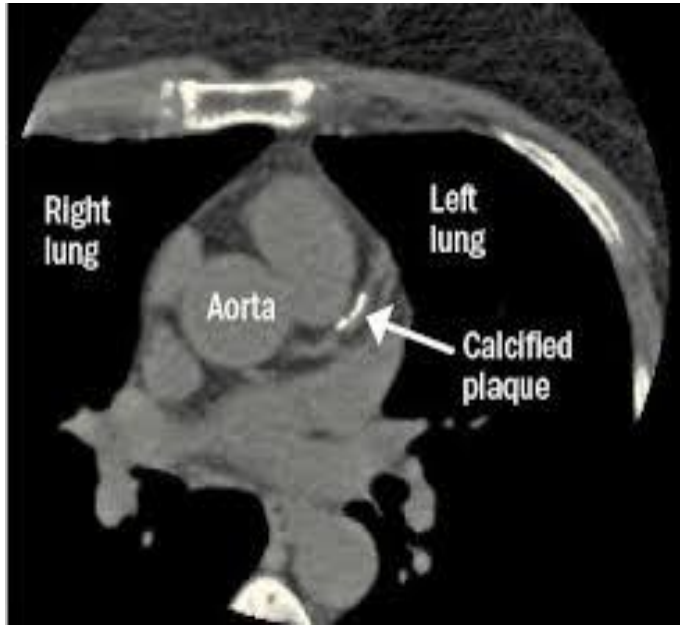
A heart CT scan may also be called a coronary CT angiogram if it's meant to view the arteries that bring blood to your heart. The test may be called a coronary calcium scan if it's meant to determine whether there's a buildup of calcium in your heart.

What is a heart MRI?

- Magnetic resonance imaging (MRI) uses magnets and radio waves to capture images inside your body without making a surgical incision. It allows your doctor to see the soft tissues in your body, along with your bones.
- An MRI can be performed on any part of your body. However, a heart or cardiac MRI looks specifically at your heart and nearby blood vessels.
- Unlike a CT scan, an MRI does not use ionizing radiation. It’s considered a safer alternative for pregnant women. If possible, it’s best to wait until after the first trimester.

MRI scan of the heart





Why a heart MRI is done?

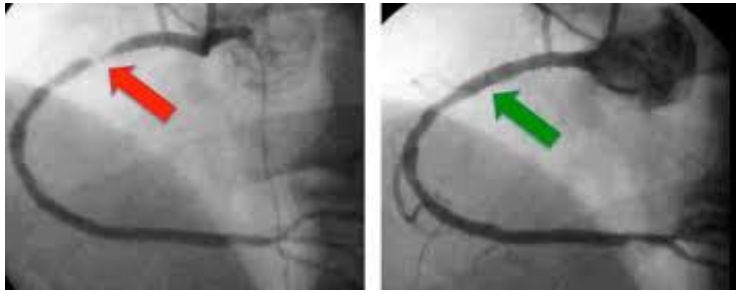
Your doctor might order a heart MRI if they believe you're at risk for heart failure or other less severe heart problems.

A cardiac MRI is a common test used to assess and diagnose several conditions.

Some of these include: congenital heart defects, coronary heart disease, damage from a heart attack heart failure, heart valve defects, inflammation of the membrane around the heart (pericarditis)

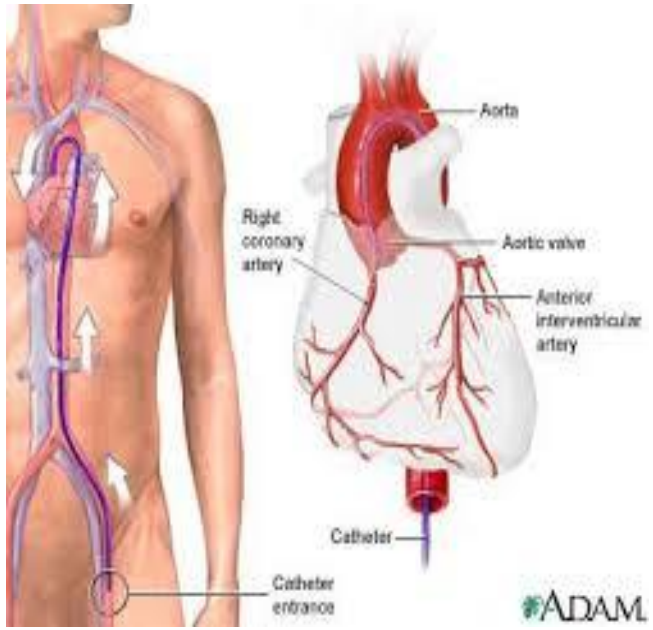
Angiography

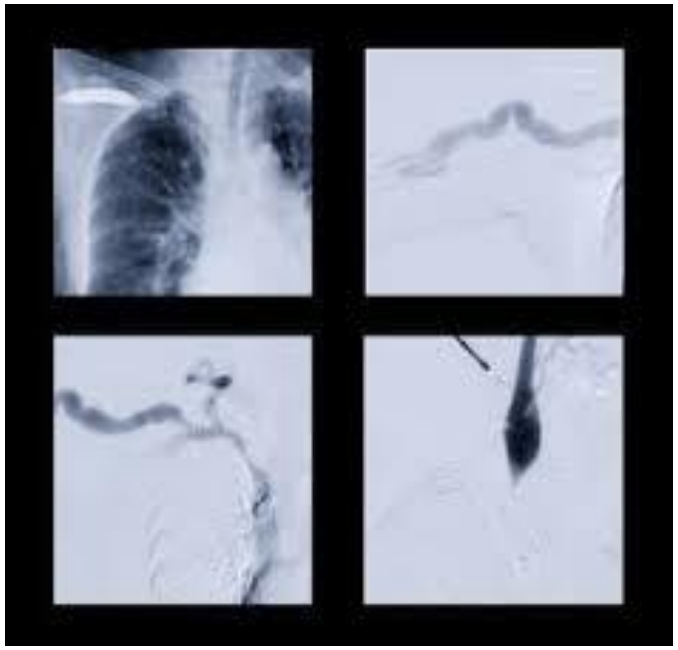
- Angiography or arteriography is a medical imaging technique used to visualize the inside, or lumen, of blood vessels and organs of the body, with particular interest in the arteries, veins, and the heart chambers. This is traditionally done by injecting a radio-opaque contrast agent into the blood vessel and imaging using X-ray based techniques such as fluoroscopy.

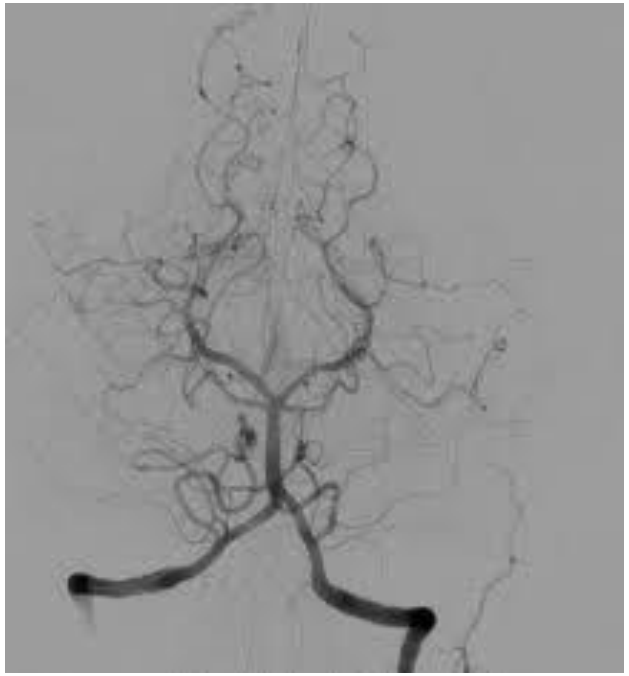


- The word itself comes from the Greek words ἀγγεῖον angeion, "vessel", and γράφειν graphein, "to write" or "record". The film or image of the blood vessels is called an angiograph, or more commonly an angiogram. Though the word can describe both an arteriogram and a venogram, in everyday usage the terms angiogram and arteriogram are often used synonymously, whereas the term venogram is used more precisely.

The technique of angiography



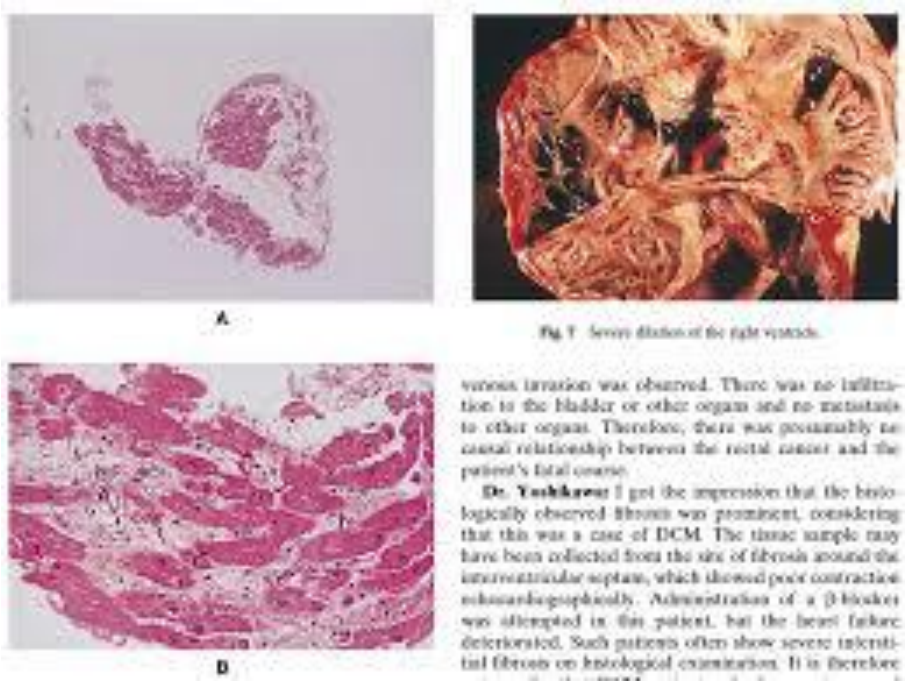


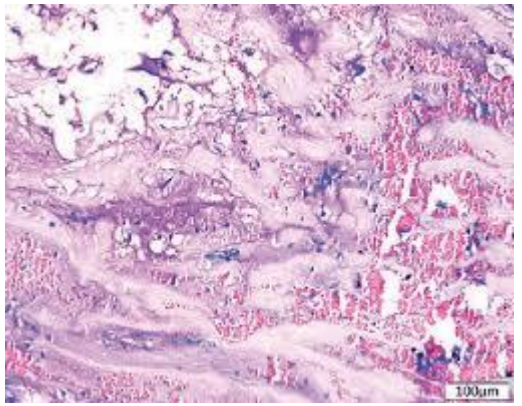


The technique was first developed in 1927 by the Portuguese physician and neurologist Egas Moniz at the University of Lisbon to provide contrasted x-ray cerebral angiography in order to diagnose several kinds of nervous diseases, such as tumors, artery disease and arteriovenous malformations.

Biopsy of the heart

Biopsy catether





Myxoma of the heart

A heart biopsy, also called myocardial biopsy or cardiac biopsy, is an invasive procedure to detect heart disease. It entails using a bioptome (a small catheter with a grasping device on the end) to obtain a small piece of heart muscle tissue that is sent to a laboratory for analysis. Diagnose myocarditis, cardiomyopathy or cardiac amyloidosis if common diagnostic tools like echocardiogram, EKG, or chest X-rays are not as helpful.

Thanks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