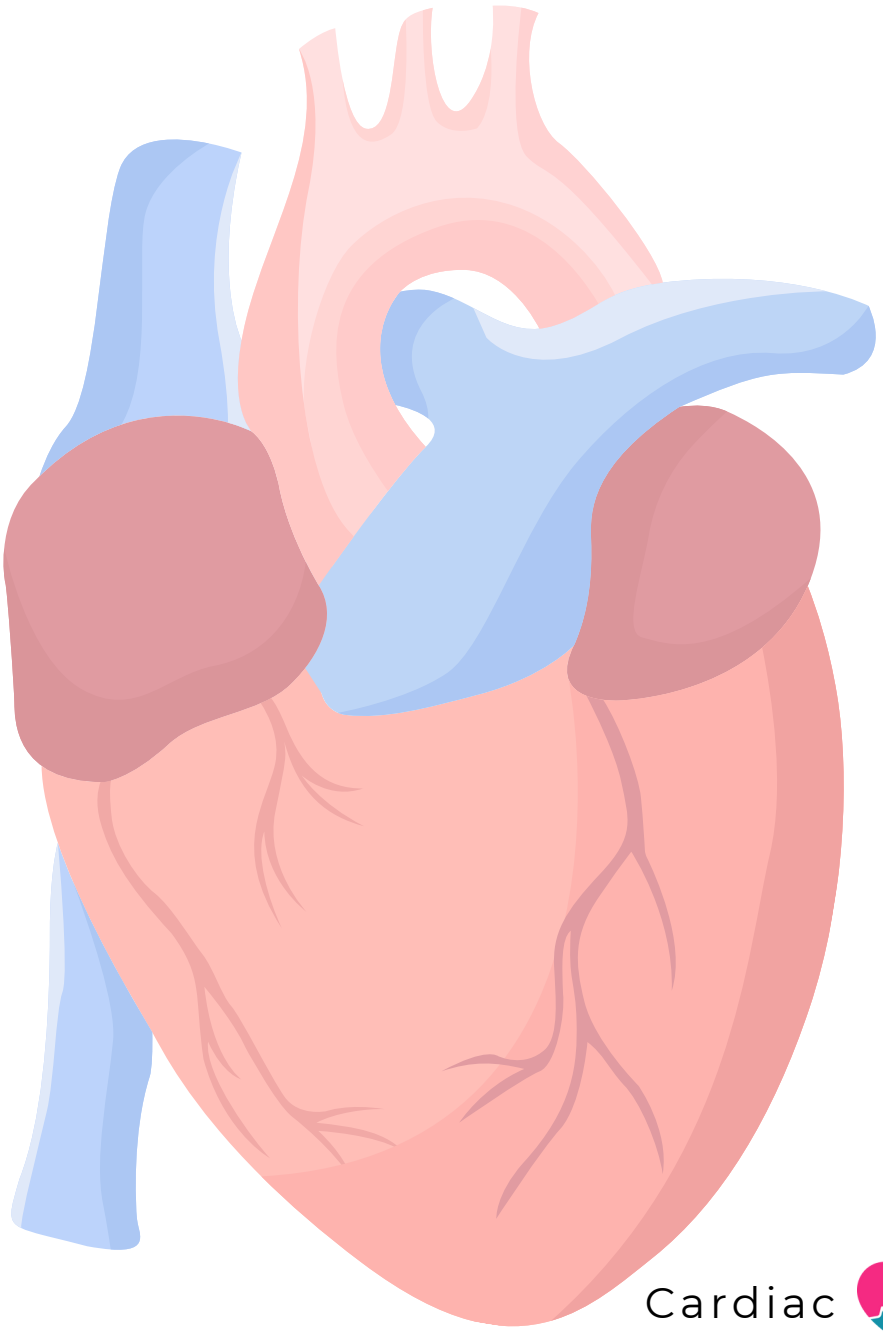
STUDY GUIDE

LEFT SIDED HEART FAILURE



Cardiac NursingSOS

STUDY GUIDE

DEFINITION

Left sided heart failure means that the left ventricle of the heart can't pump enough blood to meet your body's needs. This means that your heart has a low cardiac output.

CAUSES

Causes of left sided heart failure can be divided up into 3 categories:

Ischemia of the heart muscle tissue

Ischemia means that there is not enough blood flow. In this case, it's ischemia of the heart tissue; the heart is not getting enough blood flow. The major cause of ischemia of the heart is a myocardial infarction (MI), which is a heart attack. During a heart attack, there is a clot or another type of blockage in one or more of the blood vessels around the heart that blood can't move past. This causes ischemia of the heart tissue because there is not enough blood flow to the rest of the heart. When the left ventricle of the heart is not getting enough blood, it is very unhappy, so it stops working properly.

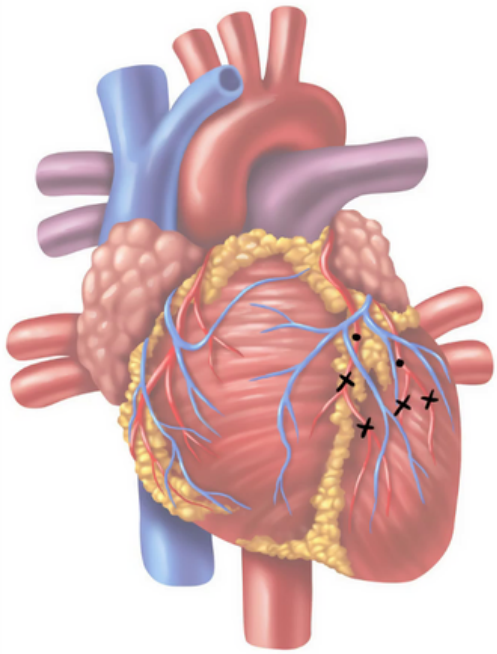


Image of ischemia of the heart muscle tissue

The left ventricle doesn't have enough blood to pump out

The 2 primary disorders that can cause this to happen are:

- **Atrial fibrillation:** During atrial fibrillation (A-fib), the atria of the heart are basically quivering and aren't able to completely fill the ventricles. The ventricles aren't getting enough blood to start with and they have less blood to pump out, but your body still needs more blood to function. So the left ventricle works harder and harder to try to push enough blood out, and it ends up getting over-worked.
- **Mitral stenosis:** During mitral stenosis, the mitral valve is not letting enough blood pass through from the left atrium into the left ventricle. Stenosis just means that it is narrow. So in this case, stenosis of the mitral valve means that the mitral valve is narrowed and can't let as much blood to pass through. This leads to the left ventricle not having as much blood to pump out to the body, which causes the left ventricle to become tired and overworked.

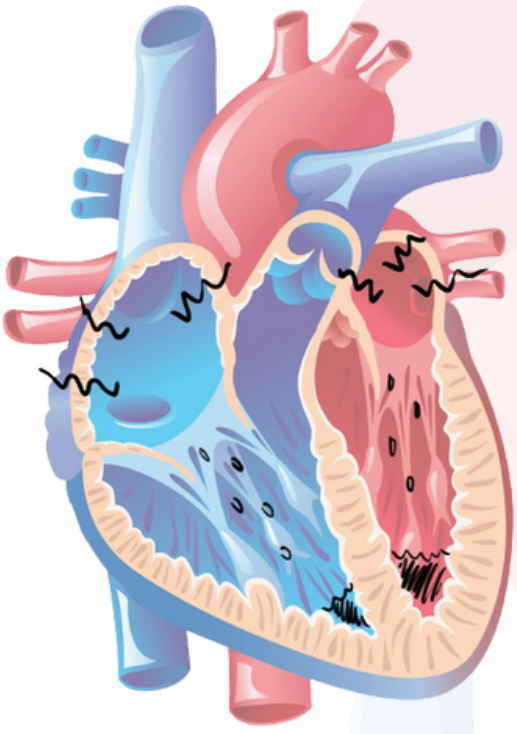


Image of atrial fibrillation

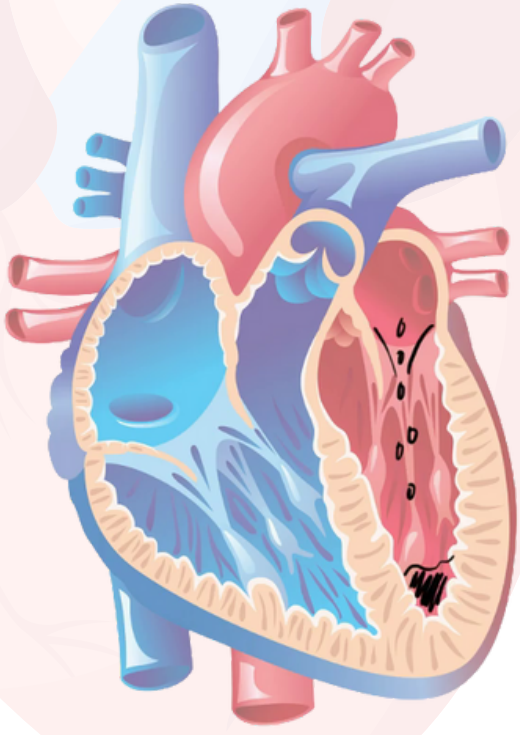


Image of mitral stenosis

STUDY GUIDE

The left ventricle can't pump out the blood it does have

This is primarily caused by one of three things:

- **Hypertension:** Think about hypertension like a straw and normal blood pressure like a water pipe. You will be able to blow air through a straw, but it won't be nearly as easy as blowing air through a water pipe; this is because a straw is smaller and there's more resistance. This is what's happening to the heart during hypertension: the blood vessels are much smaller and the heart can't pump as much blood out as it normally would. It also has to work a lot harder to pump that blood. So hypertension causes the left ventricle to work a lot harder, and it gets tired trying to pump out all of the blood it does have.
- **Aortic stenosis:** The same thing happens with aortic stenosis; remember that stenosis just means narrowing. In this case, stenosis of the aortic valve means that the aortic valve is narrow and can't let as much blood through. Like hypertension, the narrowed hole of the aortic valve increases resistance so the left ventricle needs to pump a lot harder to get the blood past it.
- **Mitral insufficiency:** Mitral insufficiency is a little bit different; it means the mitral valve is letting blood backflow from the left ventricle into the left atrium. Unlike hypertension and aortic stenosis, there is blood going to both the aorta and out to the body, as well as blood back flowing into the left atrium. The left ventricle still can't pump out all of its blood into the body because some of the blood is actually going backwards in the system into the left atrium!

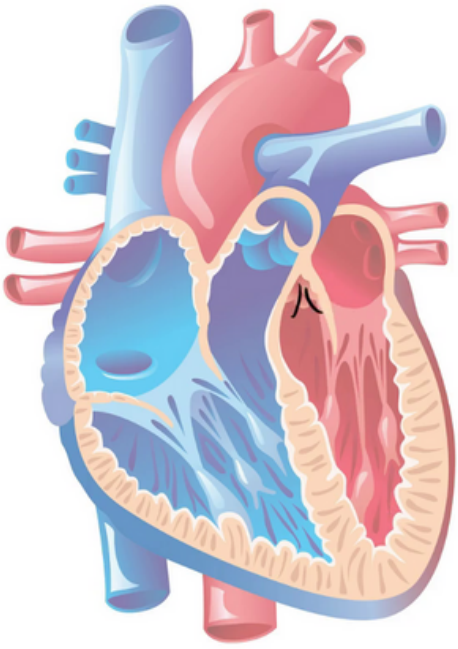


Image of aortic stenosis

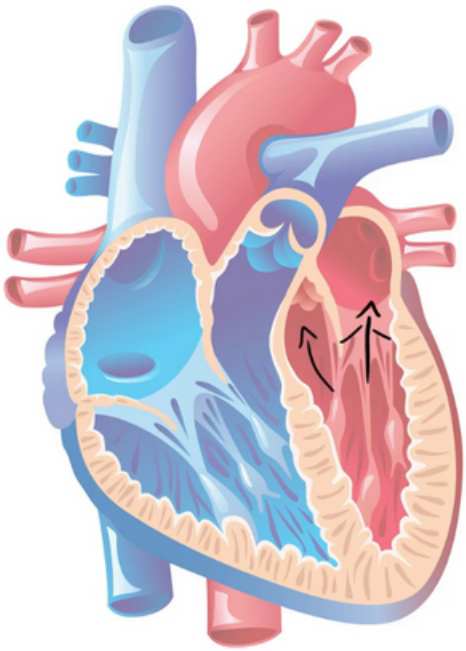


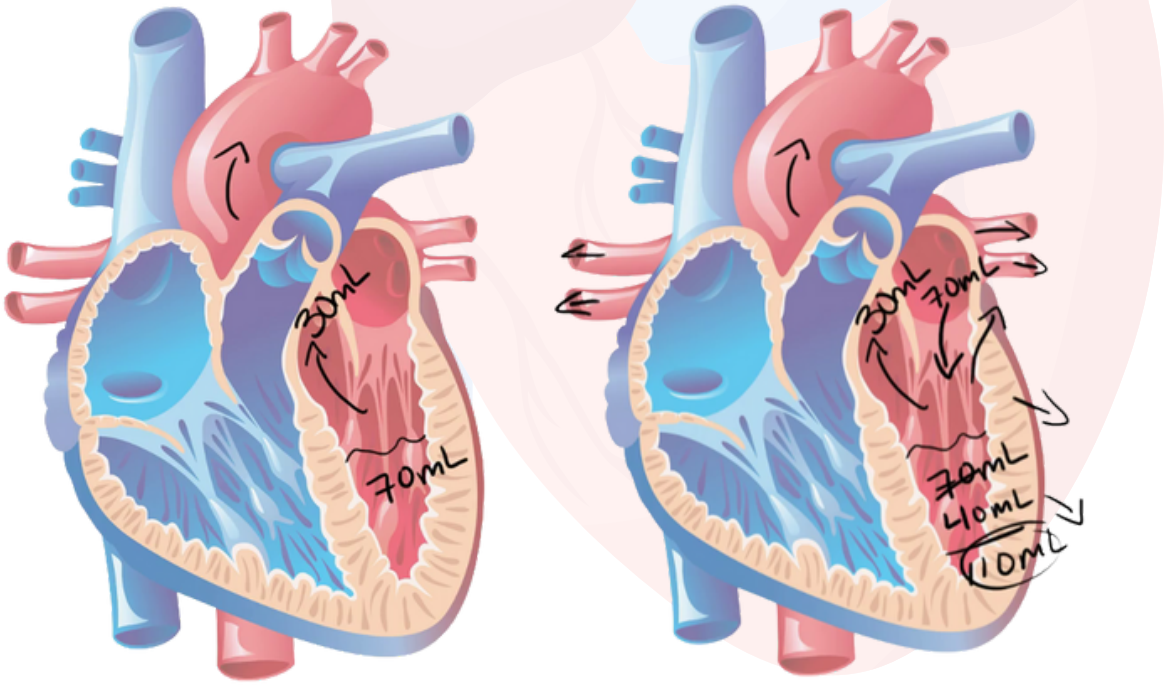
Image of mitral insufficiency

PATHOPHYSIOLOGY

There are 2 types of left sided heart failure:

- **Systolic heart failure:** The heart muscle gets tired and can't contract forcefully enough to pump enough blood out
  - Ideally, there is 70mL of blood that fills the left ventricle between each heartbeat; that full 70mL of blood should be pumped out by the left ventricle during each heartbeat.
  - But, in systolic heart failure, there may be 70mL of blood entering the left ventricle, but only 30mL is being pumped out; that leaves 40mL of blood left sitting in the left ventricle.
  - However, because the rest of the heart is working so nicely, another 70mL of blood just filled the left ventricle again, adding to the 40mL that was still sitting in there. That's a total of 110mL of blood that has filled the left ventricle!
  - This causes the left ventricle to stretch and blood to back up into the left atrium, through the pulmonary veins, and into the lungs.

Systolic heart failure: the heart cant effectively empty the left ventricle.

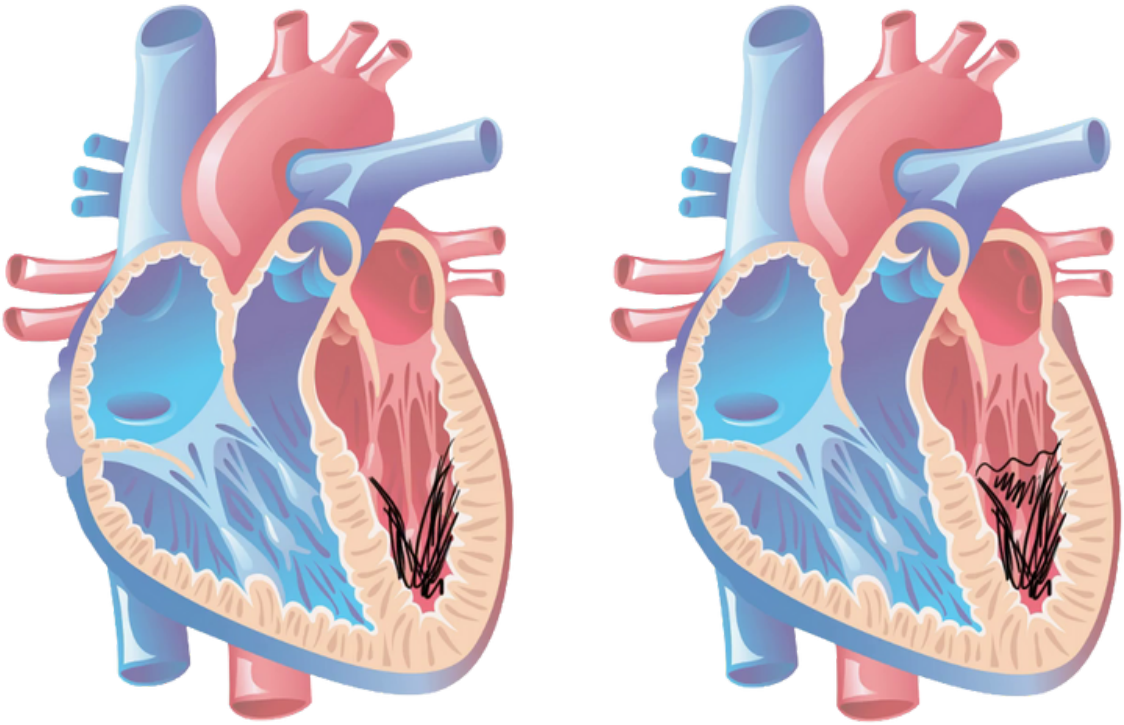


Images of systolic heart failure

STUDY GUIDE

- **Diastolic heart failure:** The heart can't relax enough to fill completely
  - The heart is a muscle. What happens when you go to the gym and work out your muscles? They get bigger! The same thing is happening to the heart: it is getting bigger and can’t fill all the way.
  - The heart muscle also gets stiff because of the built up scar tissue from working so hard over time. You know how your muscles feel when you don't stretch after working out? That's what's happening to your heart: it hasn't been stretching after all of it's workouts. Scar tissue can't stretch as much, so your heart muscle gets stiffer.
  - Both of these factors prevent it from fully relaxing and letting in enough blood into the ventricle.

Diastolic heart failure: the heart won't relax enough to fill the ventricles effectively



Images of diastolic heart failure

In both systolic and diastolic heart failure, there is a decreased cardiac output, which causes the symptoms of left sided heart failure.

SIGNS AND SYMPTOMS:

The signs and symptoms of left sided heart failure don't come from the heart failure itself, but from the decreased cardiac output that results from left sided heart failure.

Pulmonary congestion, crackles in the lungs, and productive cough

Because the blood is backing up into the lungs, it makes sense that you would hear crackles indicating pulmonary congestion and that the patient would have a productive cough. A productive cough means that there is stuff coming up and that it's not a dry cough. There is excess blood, and therefore excess fluid in the lungs, causing crackles and a productive cough.

Shortness of breath and increased respiratory rate (tachypnea)

The patient may also have shortness of breath and tachypnea, which means a respiratory rate above 20 breaths per minute. The shortness of breath comes from the lungs being full of fluid, and if the patient can't breathe really well, they breathe faster to try to get more air.

Since the left side of the heart isn't able to keep up with the demands of the right side of the heart pumping the blood to the lungs, the blood gets backed up into the lungs, causing respiratory symptoms.

Weak peripheral pulses and pale and cool extremities

Because the blood is going backwards into the lungs and not forward into the body, expect to see weak peripheral pulses and pale and cool extremities since there's no blood there!

Fatigue and weakness

The patient may also have fatigue and weakness because their body is not getting the blood, nutrients, and energy it needs to function.

Mental status changes (confusion)

They may also have mental status changes and confusion because their brain isn't getting enough blood either.

Decreased urine output during the day (oliguria), but increase urine output at night (nocturia)

Changes in urination is also possible. They may have a decreased urine output during the day (oliguria) and an increase in urine output at night (nocturia). This is because when the patient is up and walking around, the heart is pumping super hard to try to get all of its blood out, but it's not able to and the kidneys are not getting enough blood to make urine. However, when the patient goes to bed and lays down, their heart can take a deep breath because it's not pumping against all of that gravity. It can perfuse the kidneys better so they make urine at night.

NURSING ASSESSMENT:

Notice how these assessments are all related to the heart not being able to effectively pump oxygenated blood out to the rest of the body (decreased cardiac output).

Alertness and orientation (A&O)

Check the patient's alertness and orientation. This is called A&O times whatever they are alert to:

- **Person:** Do they know who they are?
- **Place:** Do they know where they are?
- **Time:** Do they know what day or year it is?
- **Situation:** Do they know how they got there or what the current situation is?

If they are alert to all 4 of these, we call this A and O times 4. If they are alert to only 3 of these, it's A and O times 3. If they're alert to only 2 of these, it's A and O times 2. If they're alert to only one, it's A and O times 1.

If they can't answer any of them correctly, it's technically A and O times 0. The patient is awake but they don't know who they are, where they are, what day or year it is, or what the current situation is.

In heart failure, if the patient's brain is not getting the blood it needs, they may not be completely oriented. So this is an important part to assess accurately.

Apical Pulse

For any cardiac patient, it is super important to take their apical pulse for one whole minute. The apical pulse is the apex of the heart, so where the ventricles are, the point going down.

The apical pulse is located:

- **Left of the sternal border:** Means to the left of the sternum, so on the left side.
- **In the 5th intercostal space:** Intercostal spaces are the spaces between the ribs. So you can feel on your patient and count down their rib cage in the spaces between their ribs. The apical pulse is located in the 5th intercostal space.
- **On the mid clavicular line:** Means down the imaginary line in the middle of your clavicle or collarbone. Draw an imaginary line down the middle of the collar bone and that is the mid clavicular line.

Hang out there at their apical pulse for one whole minute. Cardiac patients' heart rates may not be regular, or follow a normal heartbeat rhythm. They may have an arrhythmia. So if you take their heart rate for only 6 seconds and multiply by 10 and call it good, you may have missed an arrhythmia and their heart rate would have been off because of it. They may also have an S3 heart sound that you will want to listen for, meaning that their heart has an extra little beat.

So it's really important that you listen for one whole minute to hear all of these things.

Lungs, respiratory rate, and respiratory rhythm

Listen to their lungs for those crackles, count their respiratory rate, and notice their respiratory rhythm, as in how deep or shallow it is and if it's regular or not. The crackles in the lungs will start out at the bases, or bottom, of the lungs, and work their way up as their lungs get more filled with blood. A patient with more severe left sided heart failure with have crackles higher up in their lungs.

In heart failure, the crackles will not go away when the patient coughs, even if the cough is productive.

Oxygen saturation

Check their oxygen saturation and expect it to be low because their heart is not pumping enough blood to perfuse their body. So of course their blood oxygen levels will be low; they have no blood!

Peripheral pulses

Feel for their peripheral pulses and note if their hands and feet are warm or cold, flesh toned or pale.

LAB VALUES AND DIAGNOSTICS TESTS:

There are 3 primary lab values for left sided heart failure:

B-Type Natriuretic Peptide (BNP)

This lab value is a sensitive indicator for diastolic heart failure because it increases when there is an increase of pressure within the heart. BNP should be less than 125 picograms per milliliter (125 pg/mL).

Microalbuminuria or Proteinuria

The second important lab value is microalbuminuria or proteinuria, meaning that there is albumin or protein in the urine. Normally, there should not be any albumin or protein in the urine, but when the kidneys are not getting enough blood, they will become damaged. I always think of damaged kidneys as holy kidneys, as in they have holes in them; holy kidneys let those larger albumin and protein molecules out and spill out into the urine.

Blood oxygen level through the arterial blood gas

The third lab value to look for is the blood oxygen level taken through the arterial blood gas (ABG). The blood oxygen level will be lower because the lungs are so full of fluid it impairs their gas exchange and the blood is not able to get enough oxygen. A normal partial pressure of oxygen (PaO2) is greater than 80 mm mercury (>80 mmHg). In a patient with left-sided heart failure, expect to see the partial pressure of oxygen be less than 80 mm mercury (<80 mmHg).

There are 3 imaging studies that can be done to either diagnose or to see the extent of left sided heart failure:

Chest X-Ray

The first imaging test is a chest x-ray, where you can actually see that the left ventricle is larger than it should be.

Echocardiogram

The second is an echocardiogram, which you can also use to see the left ventricle enlargement. It can also show you how the valves are functioning, if there's any fluid build up around the heart (such as a pleural effusion), and the ejection fraction of the heart (meaning what percentage of blood it is pumping out).

Multigated Acquisition Scan (MUGA Scan)

And the last imaging test is the MUGA scan. This one can also tell you the ejection fraction of the heart and how forcefully it contracts. This can help you figure out how much damage there is.

The doctor will order scans based on what information they need. If they only need to visualize the heart, a chest x-ray would probably do just fine. But if they needed more information, like the ejection fraction, an echocardiogram or MUGA scan would probably be the best route.