

v-V Optimization and A-V Optimization

What is it?

V-V and A-V optimization are two non-invasive procedures available in the Penn State Hershey Medical Center Echocardiography Laboratory. Under the supervision of a PSHMC cardiologist, staff will interrogate and make a series of changes to your pacemaker settings. Throughout the procedure, echocardiography will be performed to assess how your heart function responds to these adjustments. After reviewing the settings and coinciding echo data, the physician will determine which pacer change will provide the greatest benefit to your heart function and quality of life.

What will happen during the test?

For both of these optimization procedures, the only things you'll experience that are different from a standard echocardiogram is there will be more people in the room than usual, your pacemaker will be frequently interrogated and the study will probably take longer. In addition to the echocardiography technologist, there will be staff on hand to make changes to your pacemaker and a physician to analyze the echo data and order changes to the pacemaker settings. Generally, you may expect this procedure to take approximately one-half hour longer than a standard echocardiogram.

If you have been referred for **V-V Optimization**: The sonographer will perform a baseline echocardiogram. From heart wall timing measurements obtained on this study, the physician will be able to detect the presence and severity of dyssynchrony involving specific heart walls. He/she can then decide what changes to make on your pacemaker settings in an effort to time the delivery of pacer impulses to the heart walls so the entire ventricle will contract in unison. With each change in pacemaker settings, the echo cardiologist will obtain more Doppler data so the physician may assess the effect of the changes until he/she arrives at a combination that is felt will enable the chamber to pump to its maximum capability.

If you have been referred for **A-V Optimization**: The sonographer will perform a baseline echocardiogram. From this, the physician will gather information about the timing and duration of the diastolic filling period. Changes are then made to the pacemaker that will alter ventricular filling properties in a manner that the physician feels will provide maximum benefit for overall heart function. Each time a change is made to the pacemaker setting, the echo technologist will collect Doppler data that demonstrates to the physician the effect each new setting has on heart filling and function. After reviewing all of the Doppler data, the physician determines which setting will provide the greatest benefit to heart function and have staff change the pacemaker to that setting.

Why is the procedure done?

V-V Optimization: In patients with weakening of the heart's main pumping chamber (Left Ventricle: muscular chamber that pumps oxygen rich blood to the body), the effect of the disease may be worsened if the walls of the chamber do not contract in a unified manner.

Even if the heart is weakened, each beat should still generate enough force to eject an adequate amount of blood to the body. But, if the walls do not contract in a unified manner (i.e., if they are out of synch), the maximum amount of force your ventricle has the potential to produce may not be achieved. Ideally when the heart muscle squeezes ("systole"), opposing walls should move toward each other in unison (i.e., all walls move toward the center of the heart chamber) to generate the force needed to eject blood from the heart.

When heart walls are out of synch, as one wall contracts and moves toward the center of the chamber, the opposing wall either moves away or squeezes later. By the time the opposing wall does contract, the original wall is relaxing, thus markedly reducing the effectiveness of the pumping action. This is referred to as desynchronization. To get an idea of the effect this action has on the heart's pumping action, try this: cup your hands together, place them in a container of water and then squeeze your palms against each other. Water shoots straight into the air, right? Now, instead of forcing your palms together, move your right palm in the opposite direction as you force the left one inward to eject the water. Not as effective, is it? This is essentially what happens in a left ventricle exhibiting desynchronization.

The echocardiography procedure commonly used to correct this problem is referred to as "V-V Optimization." The goal of the procedure is to time your pacemaker in a way that the pulses from the pacemaker will help organize the contraction pattern of your left ventricle and improve its overall pumping action.

A-V Optimization: In addition to improving the timing of heart wall contraction, echocardiography is used to maximize pacemaker effectiveness as it reflects on filling of the left ventricle.

Utilizing the procedure referred to as "A-V optimization," the cardiologist is able to improve the efficiency of the Left Ventricle by optimizing your pacemaker settings in a manner that will alter the timing of blood flow from the Left Atrium (chamber on top of the left side of the heart that receives oxygen rich blood from the lungs) into the Left Ventricle.

The period during which the left ventricle fills with blood is called "diastole." Proper coordination between systole (squeezing) and diastole (filling) is very important. Sometimes changes in this filling period may occur in patients with pacemakers. In certain cases, diastole may take so long that the heart begins to squeeze before the valve controlling the filling (Mitral Valve) has closed. When this happens, some of the blood is sent back into the left atrium instead of out to the body. Other times, the filling period is too short and the mitral valve closes before the left atrium can send a final contribution of blood to the left ventricle. This leads to insufficient filling of the left ventricle and can increase pressure in the left atrium.

How to prepare for the test?

There is no preparation required for this exam. Dress comfortably. You will be required to remove any clothing from the waist up and put on a patient gown.