Cardiac Surgery: Heart Valve Disease

Your healthcare team may have discussed the need for heart valve surgery with you. To better understand these discussions and what to expect, this brochure will explain how the heart valves work, the types of valve disease and the surgeries to treat them.

If you have questions, ask your physician or nurse.

Understanding valve disease

To understand heart valve disease, it is helpful to understand how the valves in the heart work. There are 4 heart valves: mitral, tricuspid, aortic and pulmonary. Valves consist of either 2 or 3 leaflets. Each valve opens and closes about 50 million times a year, up to 4 billion times in a typical lifetime! The valves keep the blood moving forward through the heart and out to the rest of the body. In a front view of the heart, Figures 1 and 2 show normal-looking mitral and aortic valves. These are the valves most often affected by disease.

Figure 1. Normal mitral valve

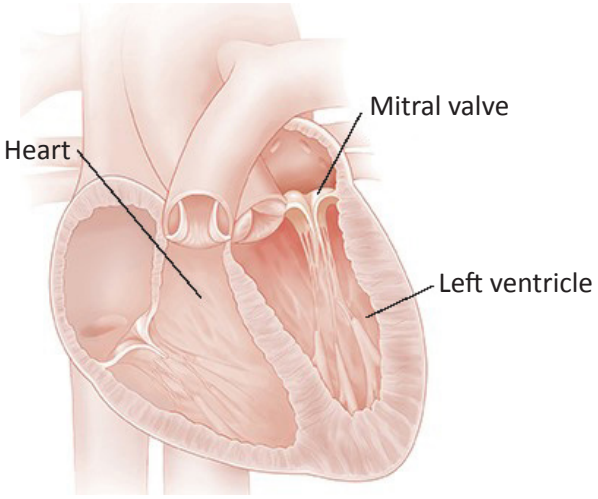
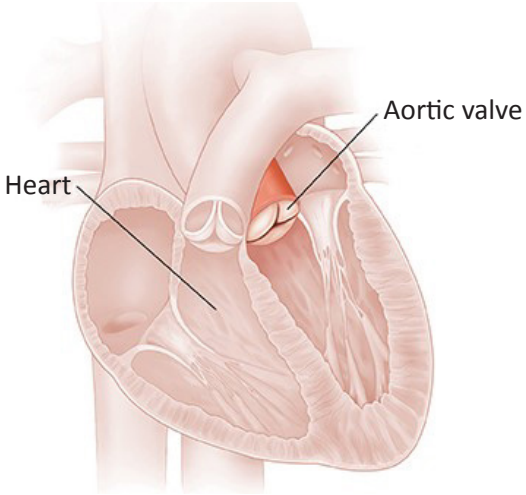


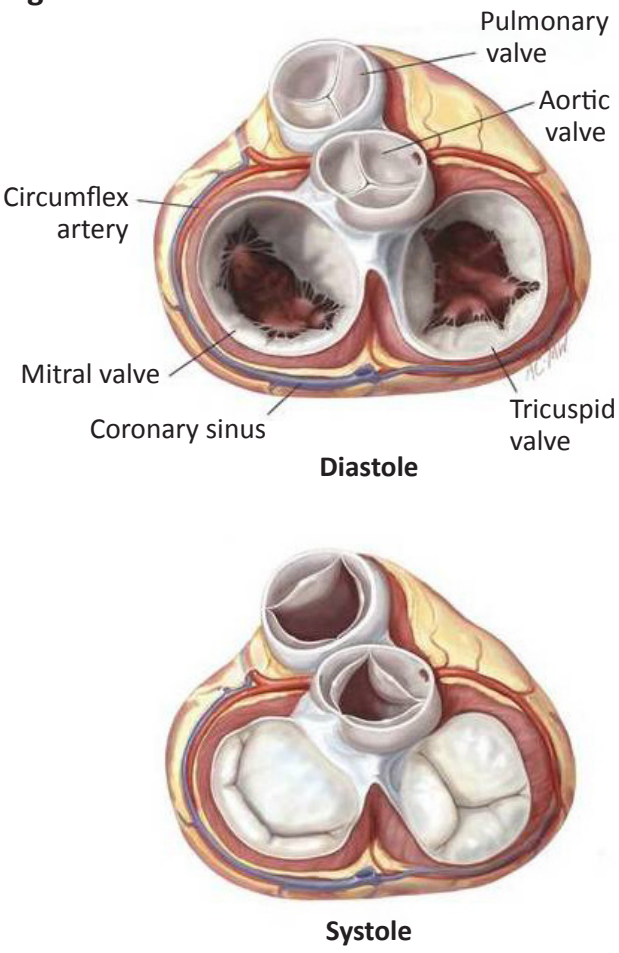
Figure 2. Normal aortic valve



When the mitral valve opens on the **left** side of the heart, it lets blood into the left ventricle (lower heart chamber). The ventricle then fills with blood. When the mitral valve closes, the aortic valve opens and blood is pumped out to the rest of the body.

Likewise, when the tricuspid valve opens on the **right** side of the heart, the right ventricle fills with blood. When this valve closes, the pulmonary valve opens and blood is pumped into the blood vessels of the lungs. This allows the blood to fill with oxygen before continuing its journey to the left ventricle and out to the rest of the body. (See Figure 3 on page 2.)

Figure 3. Normal heart valves



Courtesy of Elsevier*

Figure 3 shows normally functioning valves as viewed from above the heart.

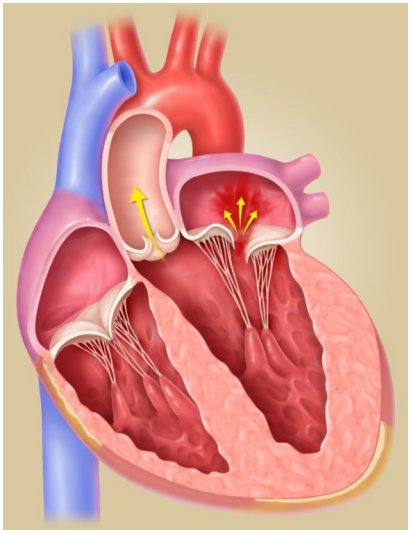
Normally, 1 set of valves opens while the other set of valves closes.

In the top view, the pulmonary and aortic valves are securely closed. The mitral and tricuspid valves are wide open. This allows blood to fill the ventricles.

The lower picture shows the pulmonary and aortic valves now completely open. The mitral and tricuspid valves are now securely closed. At this time, blood is pumped out of the ventricles.

In heart valve disease, the valve leaflets do not open or close properly. This affects the blood flow. Two common heart valve problems are valve regurgitation (insufficiency or leaking) and valve stenosis (narrowing or obstruction). Both regurgitation and stenosis cause the heart to work harder. This may then lead to heart failure. Each of these conditions is briefly explained below.

Figure 4. Back flow of blood



Valve regurgitation

Regurgitation occurs when the valve does not close tightly. This causes blood to flow backward instead of forward.

The 3 small yellow arrows in Figure 4 show the back flow of blood through a diseased mitral valve.

This occurs at the same time the heart is trying to pump the blood out into the body (large yellow arrow).

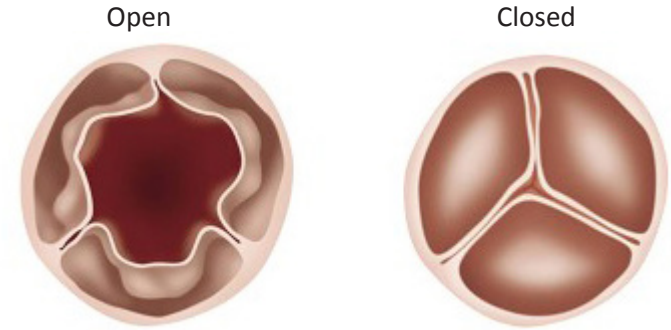
Valve stenosis

Stenosis occurs when the valve does not fully open. This limits the amount of blood that flows through. Figure 5 shows how the valve leaflets change in appearance.

The top pictures show a normally functioning aortic valve. On the top left side, the valve is wide open to let the blood flow out. On the top right side, the valve is closed when it is at rest.

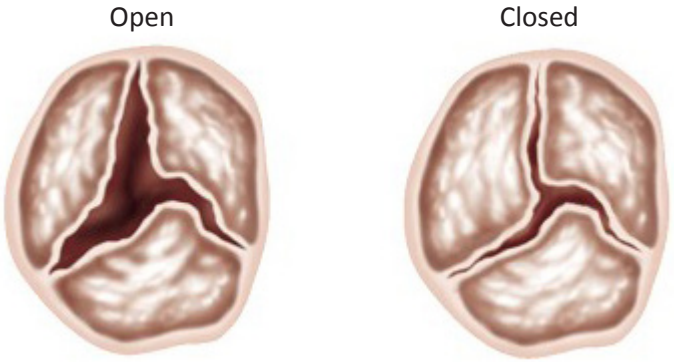
Below that, the aortic valve is unable to fully open and fully close. This makes it harder for the blood to pass through, causing it to back up.

Figure 5. Normal and stenotic aortic valve



Normal aortic valve

Courtesy of Edwards Lifesciences LLC, Irvine, CA**



Aortic valve stenosis

Causes of valve disease

Valve disease may have many different causes, such as:

- Degenerative disease
- Calcium buildup on and around the valve leaflets
- Bicuspid aortic disease (present at birth)
- Genetic disorders (born with valve disease)
- Heart damage
- Cardiomyopathy (enlarged heart)
- Rheumatic heart disease
- Endocarditis (infection)
- Heart tumors

Your physician will discuss your specific cause with you to help you understand your treatment options.

Symptoms of valve disease

Symptoms of valve disease may occur suddenly or develop gradually. They may include:

- Fatigue
- Chest pain
- Palpitations
- Feeling dizzy or faint
- Swelling in the ankles and feet
- Shortness of breath (may get worse during activity or when lying down)

For more information about valve disease and the Northwestern Medicine Center for Heart Valve Disease, please go to **heartvalvedisease.nm.org**.

Assessment of patients with valve disease

Before planning surgery, you will need to come to the Center for Heart Valve Disease. Here you will be seen by physicians and nurses who are experts in this field. They will talk with you in detail about your medical history, your valve disease and any symptoms you may be having. You will also have an in-depth physical exam that focuses on heart murmurs and other signs of valve stenosis or regurgitation.

Your physician may also wish to see other test results that show how well your heart and valves function. These include:

- Echocardiogram (echo). An echo is an ultrasound of your heart. It is the most common test used to evaluate heart valve disease. It shows real-time heart and valve function. Often an echo is done before and after an exercise test to show how the heart responds to stress.
- Transesophageal echo (TEE). In some cases, this is needed for an even clearer look at your heart valves.
- CT scan. This may be needed to provide a detailed 3-dimensional (3-D) image of the heart.
- MRI scan. Sometimes used instead of a CT scan, the MRI may be needed to provide a more detailed look at how well the heart chambers function and how much valve regurgitation exists.
- Cardiac catheterization. Finally, this may be needed to precisely define any blockages in your coronary arteries and to measure the pressures within the heart. For this test, a small catheter is inserted into the wrist or groin, and threaded up to the heart.

For more information on testing, please refer to the “Pre-surgery evaluation” section of the Northwestern Memorial Hospital brochure *Heart Surgery: A Patient Guide*.

Surgical treatment of valve disease

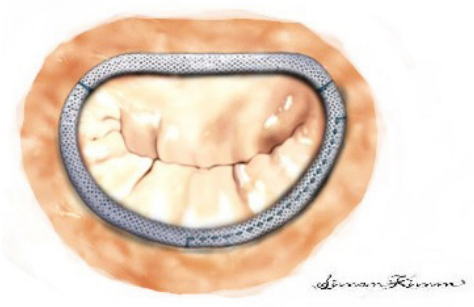
Treatment depends on symptoms and severity of the disease. Treatment may include medication or surgery. Surgery may consist of either valve repair or valve replacement.

Valve repair

The heart surgeons will repair a valve whenever possible. This often provides the best long-term outcome in restoring proper valve function. During heart valve repair, the surgeon trims, reshapes or rebuilds your valve. A ring is placed at the base of the heart valve to provide added support to the repaired valve (Figure 7). This procedure is called an annuloplasty. Figures 6 and 7 show the mitral valve before and after it is repaired. You will need to take an anticoagulant medication for at least 3 months **after** valve repair surgery.

Figure 6. Diseased valve

Figure 7. Valve after annuloplasty



Valve replacement

If the valve cannot be repaired, you will need a new valve. Your surgeon will remove the diseased valve and sew a new one into place. There are 2 main types of replacement valves: bioprosthetic (tissue) valves or mechanical valves. Valves come in different sizes and materials.

Bioprosthetic (tissue) valve: Tissue valves are made from animal or human tissue. The durability of a valve depends on your age at the time of implant. If you receive the valve at a young age, it is more likely that you will need another valve in the future. Figure 8 shows one type of tissue valve.

You will need to take anticoagulant medication for 3 months **after** tissue valve surgery.

Figure 8. Bioprosthetic valve

Courtesy of Edwards Lifesciences LLC, Irvine, CA**

Mechanical valve: Mechanical valves (Figure 9) are durable and designed to last a lifetime. However, there is a risk of blood clots with these valves, which increases with each year after surgery. Blood clots may lead to strokes or other serious health problems. Therefore, anticoagulation ("blood-thinning") medications are needed indefinitely if you receive this type of valve. This may require some adjustment to diet and to sports, if you are active. If you become unable to take these medications, you would need surgery to replace the mechanical valve with a tissue valve.

Figure 9. Mechanical valve

Courtesy of On-X Life Technologies, Inc.

Alternatives to open heart surgery

The valve surgeries previously discussed are considered "open heart surgeries." This is because the surgeon makes an incision either through the chest or ribcage to directly access the heart. This is the conventional method.

If open heart surgery is not a good option for you, there are alternatives. In this case, your physician may recommend one of the following procedures.

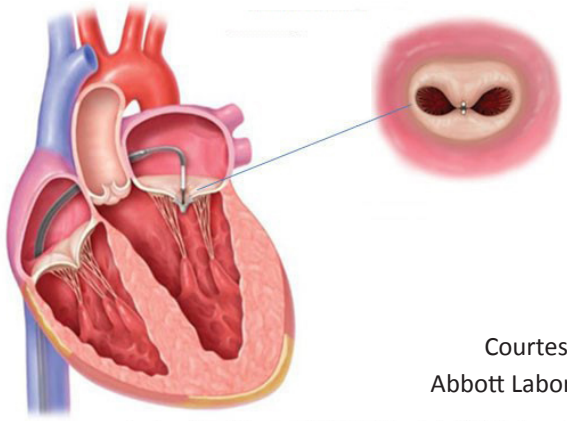
Transcatheter aortic valve replacement (TAVR): In a TAVR procedure, a bioprosthetic valve is used to replace the diseased aortic valve. The cardiologist inserts a tube (catheter) through an artery in the groin or through a small incision between the ribs. The catheter is threaded up the artery until it reaches the heart. Then, the new valve is inserted within the old valve. Figure 10 shows the new valve in place after a TAVR procedure.

More information about TAVR is available at **heartvalvedisease.nm.org/transcatheter-aortic-valve-replacement.html**.

Figure 10. Implanted transcatheter aortic valve

Transcatheter mitral valve repair (MitraClip®): The MitraClip uses a "clip" to join the mitral valve leaflets together. (Figure 11). This reduces the backward flow of blood and allows the heart to function more efficiently.

Figure 11. MitraClip procedure



For this procedure, the physician inserts a catheter through a vein in the groin. The catheter is threaded up to the heart. Figure 8 shows how the catheter is passed through the septum of the heart to insert the clip. Ultrasound imaging confirms placement. Multiple clips may be placed if needed. More information about the MitraClip procedure is available at **heartvalvedisease.nm.org/mitraclip-for-mitral-regurgitation.html**.

Valve surgery risks

Every surgery carries some risk. The amount depends on such factors as your age and overall health. Risks may include bleeding, infection, and lung or heart problems. Atrial fibrillation (a type of irregular heart rhythm) is one example of a heart problem that may occur after surgery. In some cases, a pacemaker or other procedures may be needed. In rare instances, stroke or kidney failure may occur. Your surgeon will discuss your individual risks with you.

After surgery: follow-up care

Follow-up care is required after all valve repair and valve replacements.

Please read the Northwestern Memorial Hospital home care brochure *Heart Surgery: Care After Leaving the Hospital* to completely understand all aspects of follow-up care. Below are a few key points.

Blood thinner medications and weekly blood tests

If you are taking blood thinners (anticoagulant medication) you will need weekly blood tests after you go home until your physician no longer needs to adjust your dose. Please refer to the medication brochure that you will receive, which provides important information about blood thinner medication.

Dental/surgical procedures
To help prevent infection to your heart valve:

- You should not have any dental procedures for 12 weeks after valve surgery.
- You will always need to take antibiotics before dental or surgical procedures in the future.
- Inform all your healthcare providers that you have had heart valve surgery, before any dental or surgical procedures are needed.
- Tell your dentist that your heart surgeon suggests following the *American College of Cardiology/American Heart Association Valvular Heart Disease Guidelines*.

Appendix A of the *Heart Surgery: Care After Leaving the Hospital* brochure provides additional information on long-term follow-up care after heart valve surgery.

Bicuspid aortic valve (BAV)

If you have BAV, please read the following. It is important to understand the nature of this disease and how it may affect you and your family.

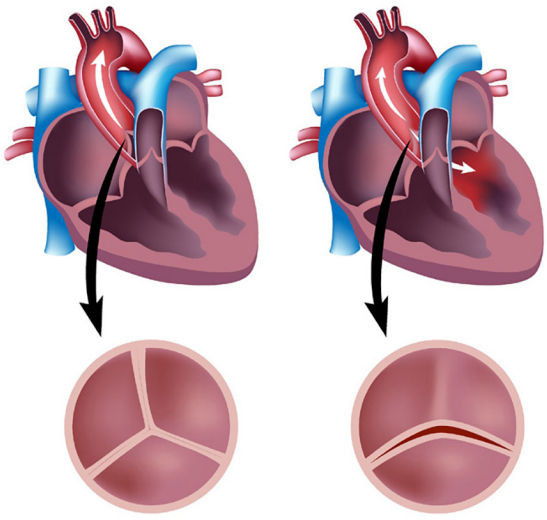
The aortic valve controls the flow of blood from the heart out to the body. Normally, the aortic valve has 3 leaflets that keep blood moving in one direction. With BAV, 2 of the 3 leaflets of the aortic valve fuse together before birth. This creates a 2-leaflet valve, instead of the normal 3-leaflet valve (Figure 12).

BAV also affects the thoracic aorta, the largest artery in the body that carries blood from the heart to the rest of the body.

A heart with BAV may work well without causing problems for a long time. However, many people **will** eventually develop complications. Then, they will need surgery either to fix the aortic valve, the thoracic aorta or both.

Present at birth, BAV is one of the most common congenital heart defects. It is at least twice as likely to occur in men as in women. BAV may be inherited in families.

Figure 12. Tricuspid and bicuspid aortic valves



Normal tricuspid valve Bicuspid aortic valve

Family screening

If you have BAV, your family members may have BAV, as well. This makes family screening very important because most people with BAV have no symptoms until they begin to have complications. Close family members (parents, siblings, children) should have an echocardiogram to see if they have BAV. An echocardiogram is a test that uses ultrasound waves to get real-time images of the heart and heart valve function.

For more information on the Northwestern Medicine BAV program, go to **bav.nm.org**. **For more information on family screening or to make an appointment, please contact our BAV nurse coordinator, at bav_rn@nm.org** or call **312.695.1989. TTY for the hearing impaired, 312.926.6363.**

*Carpentier's Reconstructive Valve Surgery, p. 27, Alain Carpentier, MD, PhD, David Adams, MD and Farzan Filsoufi, MD, Saunders (2010) Elsevier, Philadelphia, PA. Permission for use obtained.

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