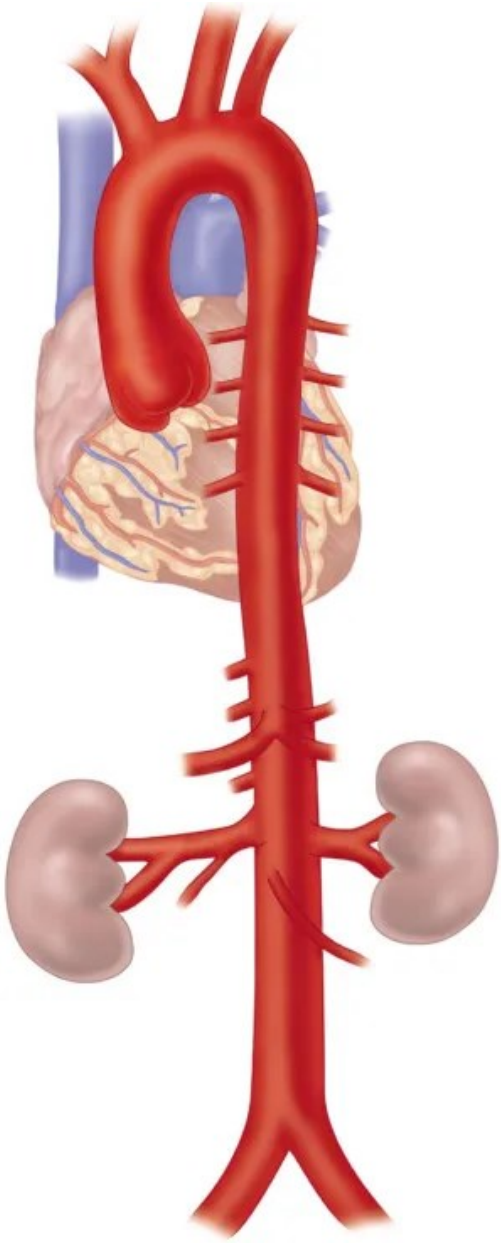
Aortic Aneurysm

Patient Education



University of Vermont Health

Center for Aortic Diseases

Questions for Your Aortic Team

Welcome Letter

Being diagnosed with aortic disease can be very anxiety producing and comes with many questions about treatment and management options. We appreciate this and the serious nature of your condition.

At the UVM Medical Center, we have a multidisciplinary team of experts to help guide you through your treatment options and recovery. We are dedicated to providing the best, most comprehensive, care to help manage your **chronic and/or acute aortic disease**. Often times chronic aortic disease is appropriately managed through diligent monitoring, but when certain thresholds are met we will work closely with you to explain and offer other treatment options, unique to each patient.

To help navigate this process our team, including our Aortic Nurse Program Coordinator, will work closely with you to answer any questions you may have and to discuss next steps. Please feel free to contact them throughout this process. We are thankful for the opportunity to work with you and your family along this journey.

Sincerely, Your UVM Aortic Team

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Division Chief of Cardiothoracic Surgery
Cardiothoracic Surgeon
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Center for Aortic Diseases

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Radiology

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Ryan Walsh, MD - Program Director, Diagnostic Radiology

Clinical Program Coordinator for Aortic Diseases

Caitlyn King, RN BSN

University of Vermont Center for Aortic Diseases is the only clinic of its kind in the region, bringing together a multidisciplinary team of vascular and cardiothoracic surgeons, cardiologists, radiologists, emergency room attendings, and critical care intensivists to diagnose and treat complex aortic diseases. Our team will work closely with you to develop a comprehensive and personalized treatment plan that minimizes your risk of serious complications and helps you live a full, healthy life.

Excellent outcomes: We track patient outcomes in national quality improvement registries, such as the Vascular Quality Initiative (VQI) and The Society of Thoracic Surgeons. Our outcomes consistently meet and exceed national benchmarks.

Advanced treatments: We offer cutting-edge, minimally invasive procedures to treat serious aortic conditions, including endovascular surgery.

State-of-the-art imaging: Our vascular laboratory and hybrid operating room are equipped with the modern aortic imaging equipment required for accurate diagnoses and perform advanced endovascular aortic procedures.

UVM Medical Center

Pharmacy Locations and Hours

- **1 South Prospect St, Level 1 Lobby Burlington, VT**
  Monday—Friday, 8:30 am—5:00 pm
- **111 Colchester Ave, Main Campus, Level 3 Lobby, Burlington, VT**
  Monday—Friday, 7:30 am—9:00 pm
  Saturday—Sunday, 8:30 am—5:00 pm
- **792 College Parkway, Fanny Allen, Medical Office Building, Suite 103, Colchester, VT**
  Monday—Friday, 8:30 am—5:00 pm

Laboratory Locations and Hours

- **1 South Prospect St, Level 1 Lobby Burlington, VT**
  Monday—Friday, 8:00 am—4:30 pm
- **111 Colchester Ave, Main Campus, Level 2, Burlington, VT**
  Monday—Friday, 8:30 am—5:00 pm
  Saturday—Sunday, 7:00 am—3:30 pm
- **792 College Parkway, Fanny Allen, Medical Office Building, Colchester, VT**
  Monday—Friday, 7:00 am—3:30 pm
  (By appointment only)

Other Services

- **Billing/Patient Financial Services**
  802-847-8000
- **Case Management and Social Work**
  802-847-3553
- **Patient Information**
  802-847-0000
- **Patient and Family Advocacy**
  802-847-3500

Parking

When you arrive at UVM Medical Center Main Campus, you can park in the underground parking garage. This is a paid garage that accepts cash, checks, and credit cards. You can also pull up to the front entrance, and we will valet park your car.

Valet parking is available from 6 am—5 pm and pick up is available until 9 pm. For pick-up after 9 pm, please call 802-847-2812. There is no charge for parking or valet if you have a handicap plate or tag.

Hotels and Lodging

UVM Medical Center has arrangements with several local Vermont hotels to provide discounted room rates (when available) to patients and family members who have to travel to Burlington from out of town.

For information about room rates and availability, contact the hotel or motel directly and mention that you're inquiring about UVM Medical Center patient and family discount.

For more information, check our uvmhealth.org webpage—Patients & Visitors > Visitor Information & Amenities > Hotels & Accommodations.

At UVM Medical Center, we never forget that the people we treat are fathers, sisters, children, loved ones. When you turn to us for your health care needs, we provide you with the kind of care you deserve – nationally recognized medical treatment, informed by the latest thinking and delivered with an individualized touch.

University of Vermont Health

Meds to Beds Program

What is Meds to Beds?

Discharging from the hospital should be about healing— not hassle. We know that after a hospital stay, the last thing you want to do is wait in line at the pharmacy. The Meds to Beds program is a free, convenient service that brings your prescriptions directly to your hospital room before you leave— so you can skip the pharmacy stop and head straight home to rest and recover. We work closely with your care team to ensure you go home with all the medications you need.

Getting your medications delivered to your room before discharge helps prevent missed doses, supports your recovery, enhances knowledge about your treatment plan, and reduces the chance of returning to the hospital— all while saving you time and stress.

How Does it Work?

Step #1: As your discharge is approaching, your hospital provider will send medication orders to the ACC Outpatient Pharmacy.

Step #2: Our team of pharmacists will work with social work, nursing team, and providers to triage medication related issues and find the best medication therapy to fit your needs.

Step #3: One of our pharmacy team members will deliver your discharge medications to your bedside and provide education about your treatment plan.

MyChart

MyChart, your personalized patient portal, is simple to use and keeps you connected to your health care — from wherever you are. If you need further assistance, our technical support team is available 24 hours a day, seven days a week at 1-888-979-1414.

Communicate with your doctor

Get answers to your medical questions from the comfort of your own home

Access your test results

No more waiting for a phone call or letter – view your results and your doctor's comments within days

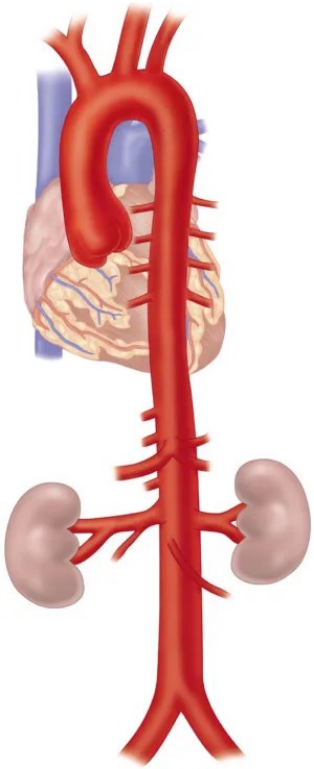
Request prescription refills

Send a refill request for any of your refillable medications

Manage your appointments

Schedule your next appointment, or view details of your past and upcoming appointments

Scan QR Code for quick link to MyChart

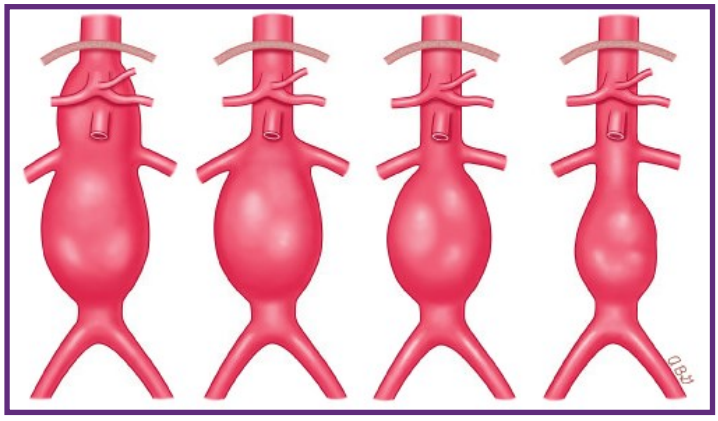


Aortic Aneurysm

What is an Aortic Aneurysm?

The Aorta

The aorta is the **largest artery (blood vessel) in the body**. Blood flows out of the top of the heart through the aortic valve into the aorta. Blood then flows down through the chest (Thoracic Aorta), into the abdomen (Abdominal Aorta) where lastly it splits into two blood vessels that supply each leg (Iliac Arteries).



Aortic Aneurysm

An aneurysm is a bulge that occurs when the wall of the aorta becomes weak or damaged.

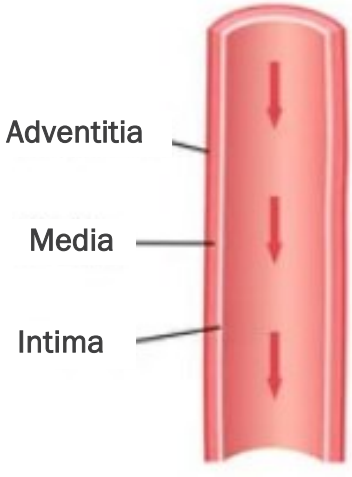
Aneurysms can develop anywhere along the aorta. The pressure of the blood flowing through the aneurysm creates a bulge at the weak spot, which causes it to "balloon" or expand in size. The bulge usually starts small. The aneurysm may grow over time as the pressure continues.

Aneurysms are most commonly found **incidentally** during image evaluation of other problems. They commonly cause no pain or discomfort and can enlarge for prolonged periods of time without being found.

When the aneurysm gets too large, it can cause pressure on neighboring organs. The wall of the blood vessel can split or "tear" (dissection) or even "burst" (rupture). This can cause life-threatening internal bleeding or other serious complications.

The Aortic Wall is divided into 3 parts –

- Tunica intima – This is the deepest layer, which is in contact with blood. This layer is very thin and prone to injury.
- Tunica media – This is thick, muscular, middle layer of the aorta. It forms the largest part of the wall.
- Tunica adventitia – This is the outermost layer of the aortic wall. It has the greatest flexible strength of all the three layers.



Types of Aortic Aneurysms

Normal
Blood Vessel

Smooth, even walls

Saccular
Aneurysm

Bulges out on one side
and the most common
type of cerebral aneurysm

Fusiform
Aneurysm

Bulges or ballooms out on all
sides of the blood vessel.
Overall the most common type.

The weakening of the walls of the aorta and later development of aneurysms can occur if you have the following conditions:

Atherosclerosis (Hardened Arteries) – Formation of plague on the inside of the blood vessels can cause high blood pressure and weaken its walls. This becomes more common with older age.

Genetic conditions – People with in inherited conditions (ex. Marfan syndrome) are prone to aortic disease including aortic aneurysms.

Inflammatory conditions – Conditions like Giant Cell Arteritis, which affect the blood vessels, can lead to aortic aneurysms.

Dysfunction of the aortic valve – If the aortic valve (the valve that lets blood flow from the heart through the aorta) does not function properly, it can cause expansion to the thoracic aorta. See page 12 for more information.

Untreated infection – Infections like syphilis and salmonella can lead to aortic aneurysms.

Traumatic injury – Trauma to the aorta can also lead to aortic aneurysms due to weakening of the blood vessel walls.

Different Locations for Aortic Aneurysms

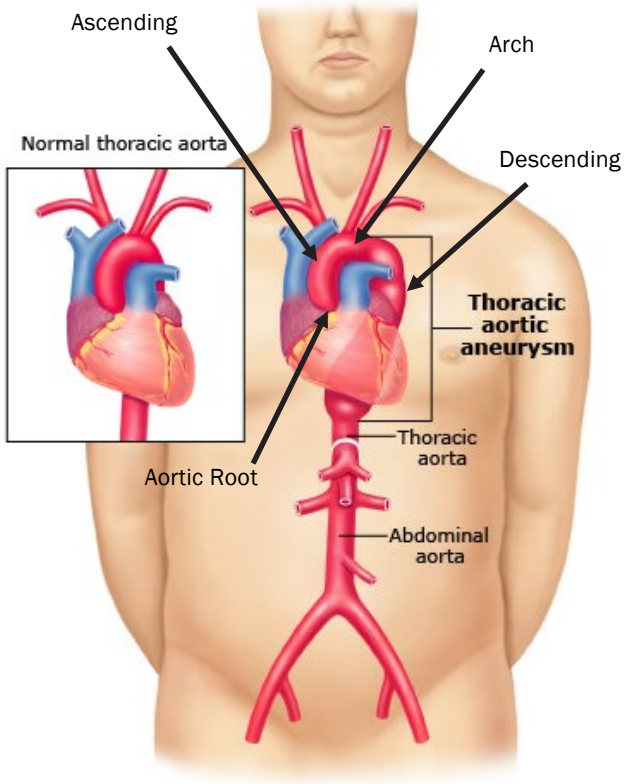
Thoracic Aortic Aneurysm (TAA)

The aorta is the largest artery/blood vessel in the body.
The thoracic aorta is broken down into 4 parts:
Aortic root - The first part of the aorta containing parts of the aortic valve and connects the heart to systemic circulation.
Ascending thoracic aorta - This is after the root and leads up towards the neck and arms
Aortic arch - This part curves upward toward the head and neck and contains the vessels that supply the brain and both arms.
Descending thoracic aorta – This part leads downward through the chest towards the belly.

What are the symptoms of a TAA?

Most people with TAAs have no symptoms. Some have pain in the chest, back, or belly. TAAs can burst with no warning. This can cause severe chest or back pain. Other symptoms depend on how big the TAA is, and which part of the thoracic aorta is affected. A TAA in the ascending aorta can cause heart problems. If the TAA presses against other parts inside the body (rare), symptoms might include:

- Cough, wheezing, or trouble breathing
- Hoarse voice
- Trouble swallowing
- Swelling of the face, neck, or arms
- Nausea or vomiting
- Rapid heart rate



Who is most likely to get a TAA?

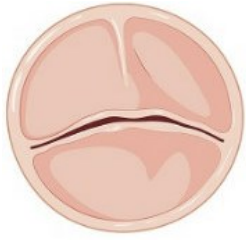
Increased risk if they:

- Are male
- Smoke, this leads to injury of the aortic wall
- Have high blood pressure
- Have high cholesterol
- Have family members who have had the condition
- Have another aneurysm, like an abdominal aortic aneurysm (which affects the lower part of the aorta) or a brain aneurysm
- Have a problem with the aortic valve, which is the valve that lets blood flow from the heart through the aorta (see page 12 for more information)

TAAs are more common in people with certain **inherited genetic** conditions affecting the connective tissues. (Connective tissues make up and support the skin, bones, blood vessels, and other organs.) Common conditions include: Marfan syndrome, Ehlers-Danlos Syndrome, and Loeys-Dietz syndrome.

Thoracic Aortic Aneurysm (TAA)

Tricuspid (3)



Bicuspid (2)

Bicuspid Aortic Valve (BAV)

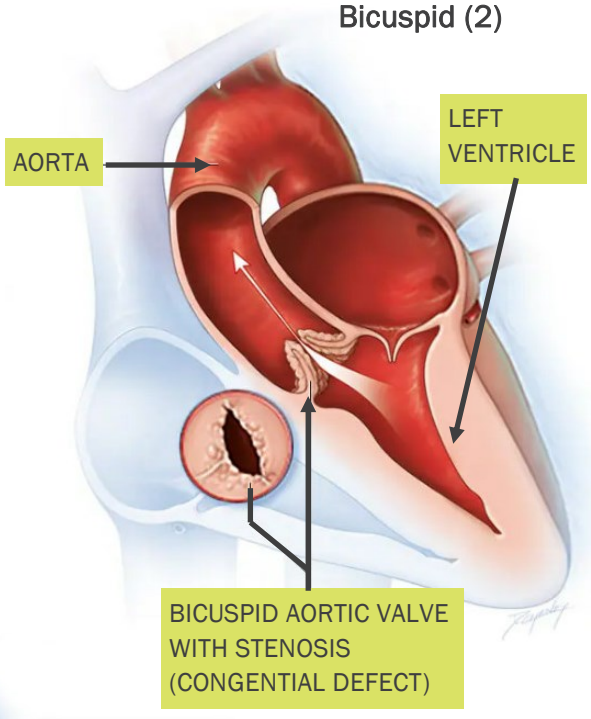
The aortic valve is located between the left ventricle of the heart and the aorta, the main blood vessel that carries blood to the body. A normal aortic valve is **tricuspid** (3 leaflets)

- In a **bicuspid aortic valve (BAV),** the valve has only **two leaflets (flaps)** instead of the usual three.
- This condition is present at birth and is one of the most common congenital heart defects, affecting approximately 1-2% of the population.
- Bicuspid aortic valve can be associated with an enlarged thoracic aorta, primarily affecting the ascending aorta.

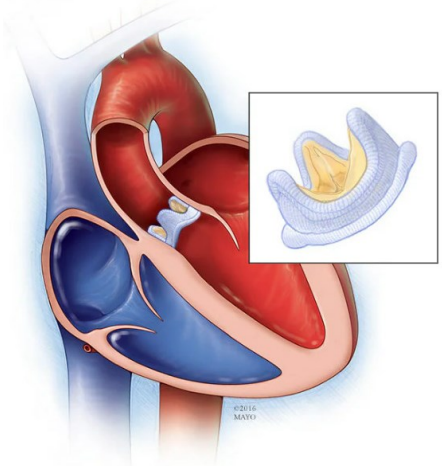
Changes to the aortic valve can cause health conditions, including:

- Narrowing of the aortic valve, called **aortic valve stenosis**. The valve may not open fully. Blood flow from the heart to the body is reduced or blocked and the heart has to work harder to pump blood
- Backward flow of blood, called **aortic valve regurgitation.** Sometimes, the bicuspid aortic valve doesn't close tightly and this causes blood to flow backward.
- **Enlarged aorta**, this increases the risk of dissection or rupture.

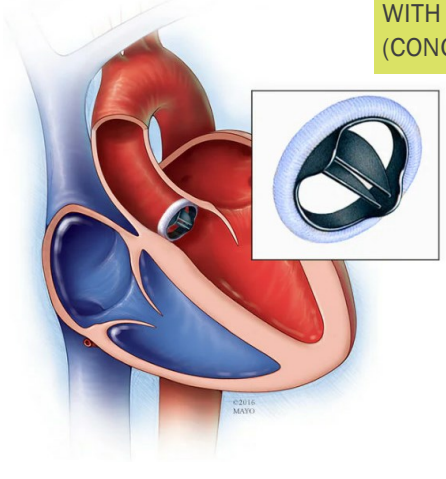
Surgery may be need if a bicuspid valve is causing the above, and sometimes is done in conjunction with aortic surgery.



There are 2 types of Aortic Valve Replacements:



Biological (tissue) valve replacement
A valve made from cow, pig or human heart tissue replaces the damaged heart valve.



Mechanical valve replacement
An artificial heart valve made of strong material replaces the damaged valve.

Different Locations of Aortic Aneurysms

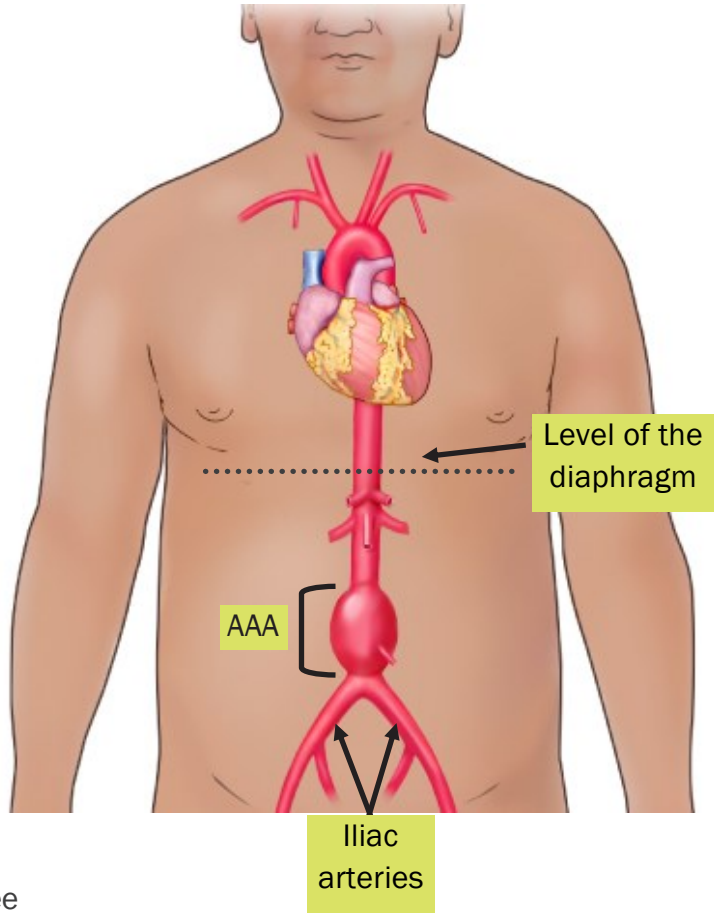
Abdominal Aortic Aneurysm (AAA)

Aneurysms can occur in any area of the aorta, but the **abdomen is the most common** site. The abdominal aorta is the part of the aorta that is located in the belly (below the diaphragm). It branches to bring blood to the organs in the belly and the legs. In people with an AAA, a part of the abdominal aorta balloons or bulges out

What are the Symptoms of an AAA?

Most people with AAAs have no symptoms. When symptoms do occur, they can include:

- Pain in the belly or back
- A small lump in the upper part of the belly that pulses, meaning that it swells and shrinks in rhythm with the heartbeat – Doctors notice this more often than patients do.



Who is most likely to get an AAA?

Your risk for having an AAA goes up if you:

- Smoke
- Are male
- Are older than 60 (with every year of life after that, your risk goes up even more)
- Have had an aortic dissection
- Have family members who have had an AAA or a related condition like a thoracic aortic aneurysm ("TAA") or aortic dissection
- Have other aneurysms, like one behind the knee

AAAs can burst with no warning. Doctors suggest that you get evaluated if there is a high risk that you might have the condition.

Screening for AAA

Doctors recommend a screening test to check for a AAA for patients with risk factors (see above). The test used most commonly to screen for AAA is called **abdominal aortic ultrasound.** This test is painless and involves the use of a wand, which is applied to the abdomen and uses high-frequency sound waves to create an image of the abdominal aorta.

Tests to Look for or at Aortic Aneurysms

Often doctors find an aortic aneurysm when a person gets an imaging test for another health reason, such as a chest X-ray, Echocardiogram (echo), or CT scan.

If a doctor thinks you might have an aneurysm, they will order imaging tests that create pictures of the inside of the body.

Thoracic Aortic Aneurysm (TAA)

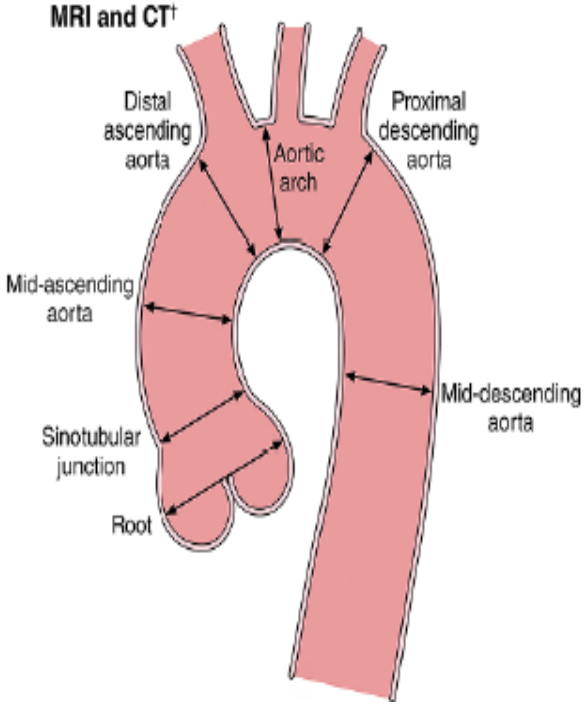
- The most common tests are CT and MRI scans. These tests create detailed images of the inside of the body. They can show if you have a TAA, where it is, and how big it is.
- Depending on your situation, you might need other tests, too. For example, if you have a TAA in the aortic root or ascending aorta (the first parts that comes out of the heart), your doctor will want to check how well your heart is working with a heart ultrasound, called an Echocardiogram. The echocardiogram can also look at your aortic valve to see if it is bicuspid or see how well the valve is functioning.

Abdominal Aortic Aneurysm (AAA)

- Since the aorta is found deep in the abdomen (belly), it is often hard to feel if there is a problem with it.
- The most common test to look for AAA is called an abdominal aortic ultrasound. For this test, a tool called a "probe" is passed over your belly. The probe uses sound waves to take a picture of your aorta.
- Your doctor will also check the pulses in your legs to feel for anything unusual.
- Other common tests to look at AAAs are CT and MRI scans.

Monitoring Your Aneurysm

If your aneurysm is small, and you are not having any symptoms, you might not need treatment to repair it right away.



YOU WILL NEED TO:

- **Get regular imaging tests** – aneurysms typically grow slowly over time. You will need tests to see if and how quickly yours is growing. Depending on how big your aneurysm is and how fast it is growing, a plan will be developed by the surgery team to determine how often imaging needs to be done and the need for treatment. Your surgeon and radiologist will measure your aneurysm size from the imaging tests
  - Tests include: CT and MRI scans, Echocardiograms, Ultrasounds, others
- Take medicine to control your **heart rate** and **blood pressure.** Monitor and record your blood pressure at home and follow up with your PCP.
- **Activity and Exercise Recommendations:**
  - Exercise is part of a healthy lifestyle because it can lower your blood pressure. It should be included in the treatment plan for all patients with aortic disease.
  - Moderate aerobic activities (swimming, walking, jogging, running, yoga, pilates) are **SAFE.**
  - Lifting light weights is OK, as long as you stop well before you cannot do another rep. Heavy weightlifting (like bench pressing) should be avoided as this movement can sharply and quickly increase blood pressure. In general, limit weight lifting to less than 50lbs.
  - Sexual activities are safe.
  - You may be advised to avoid contact sports.
- **Call your doctor** if you start having sudden pain in your chest, back, or belly. Pain can be a sign that the aneurysm is dissecting or bursting.
- Avoid a Class of **Fluoroquinolone Antibiotics** (such as ciprofloxacin and levofloxacin commonly used to treat urinary and respiratory infections) as they may be associated with an increased risk of aortic aneurysm or dissection.
  - Discuss this with your PCP or prescribing provider. There are many different antibiotics under this Class.

Mental Health and Well-Being

Living with Aortic Disease

Individuals who have experienced aortic disease (dissection or those who are at risk of aortic dissection) often experience diverse emotional reactions due to their health status.

Navigating the recovery and management of aortic disease is often confusing and overwhelming. Aortic disease is a lifelong chronic disease that is often accompanied by feelings of isolation, anxiety and/or depression and sometimes PTSD. It is important to help patients validate their feelings and establish healthy relationships that can help them cope with their diagnosis.

Aortic Hope

aortichope.org

Mission: serves a community of patients, survivors, and caregivers living with aortic disease.

Aortic Dissection: The Patient Guide (free booklet on website)

John Ritter Foundation for Aortic Health

johnritterfoundation.org

The foundation words to fund research, provide education and raise awareness of thoracic aortic aneurysm and dissection.

johnritterfoundation.org/mental-health

The John Ritter Foundation for Aortic Health has supported the development of educational resources addressing mental health topics.

Life With Aortic Disease: Caring For Your Mental Health (free booklet on website)

THINK AORTA US

www.thinkaorta.us

thinkaorta.us/think-family

#ThinkAortaThinkFamily

Campaign committed to saving lives by increasing the correct identification and diagnosis of aortic dissection. #ThinkAortaThinkFamily

Aortic Dissection: The Patient Guide (free booklet on website)

Aortic Bridge

www.aorticbridge.org

Public charity whose members include patients with aortic disease, survivors of aortic operations, care givers, medical professionals, nurses and physicians.

Goal: to provide support and education for patients, families, care givers, health care professionals and physicians with respect to aortic disease.

Aortic Dissection Awareness

aorticdissectionawareness.org

National patient charity for Aortic Dissection in the UK & Ireland.

Mission: to ensure that every family affect by this disease has access to the best available information, care and support.

Aortic Dissection: The Patient Guide (free booklet on website)

When are Aneurysms Treated?

It depends. If your aneurysm is small, not changing in size, and you are not having any symptoms, you might not need treatment to repair it right away.

When Should Aneurysms be Repaired?

Repair is the best treatment if your aneurysm is at risk of bursting (rupturing). Your doctor can help you understand your surgical risk based on:

- How large your aneurysm is (size)
- The location of your aneurysm
- How quickly your aneurysm is growing
- Your other conditions or health problems play an important factor with surgical risk.

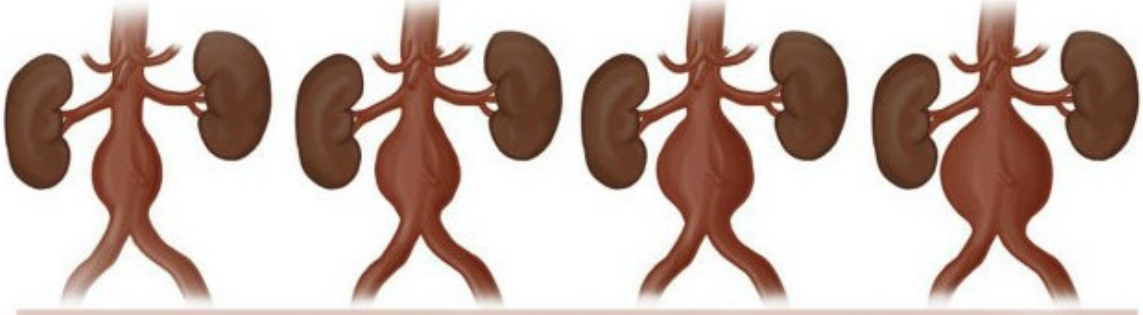
Surgery is offered when the risk of rupture outweighs the risks associated with surgery.

Typical Thresholds for Aortic Aneurysm Surgery (*these are typical sizes and may vary based on other patient risk factors*):

- Your aneurysm is causing any symptoms.
- Thoracic Aortic Aneurysm (TAA)
  - Your TAA is bigger than **5.0-5.5 cm in diameter**
  - Your TAA grows more than 0.3 cm per year in 2 consecutive years, or grows greater than 0.5 cm in 1 year
  - *Lower thresholds for those with connective tissue disorders or heritable thoracic aortic diseases*
- Abdominal Aortic Aneurysm (AAA)
  - Your AAA is bigger than **5.5 cm in diameter for men**
  - Your AAA is bigger than **5.0 cm in diameter for women**
  - Your AAA grows more than 1 cm in a year or is 0.5 cm bigger in 6 months.

*(Data and recommendations based on **2022 American College of Cardiology/American Heart Association Aortic Guidelines**)*

JVS/SVS Annual Rupture Risk Estimate—Stratified by AAA Diameter



AAA DIAMETER	3.0 - 5.4 cm	5.5 - 6.0 cm	6.1 - 7.0 cm	>7.0 cm
RUPTURE RISK	0 - 1.6 %	2.2 - 5.4 %	3.2 - 6.4 %	5.2 - 7.9 %

How Are Aneurysms Repaired?

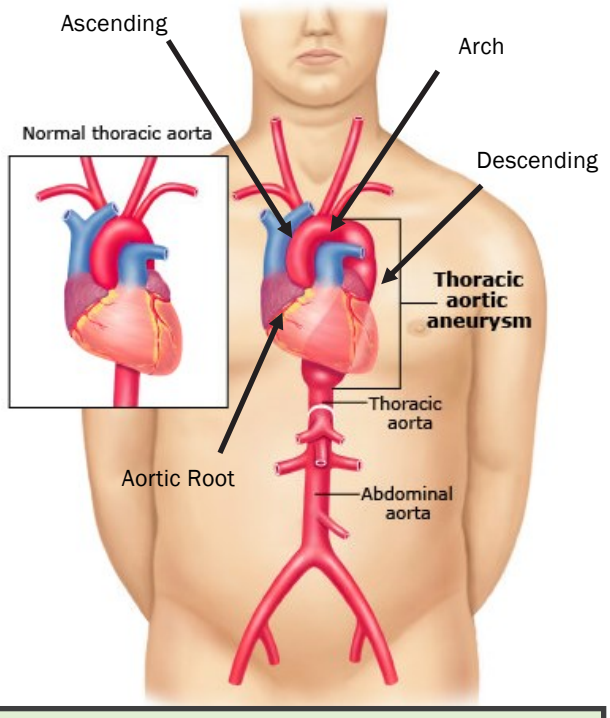
Thoracic Aortic Aneurysm (TAA) - Open Surgery

It depends on location and size of your aneurysm. It also depends on your age, health, and other medical conditions.

If your thoracic aortic aneurysm (TAA) or aortic disease is in the aortic root and/or ascending thoracic aorta (the part closest to the heart), it needs to be repaired with **open surgery**. If the diseased aortic segment is anywhere in the arch or descending thoracic aorta, open surgery might also be indicated. Sometimes your surgeon will also replace your aortic valve if it is not functioning well at the same time as your aneurysm surgery.

- Open thoracic aortic repair involves open heart surgery, cardiopulmonary bypass and sometimes circulatory arrest.

Anatomy is evaluated using imaging such as CT scan, MRI, or echocardiogram (ultrasound of the heart).



Procedure

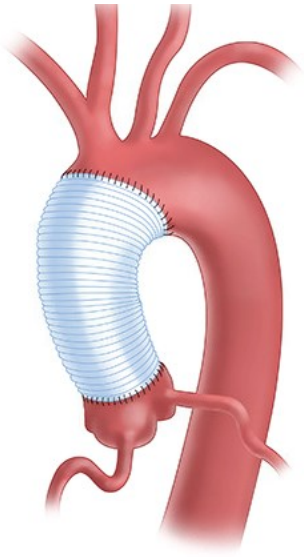
- Performed under general anesthesia.
- The doctor will need to cut open your chest/breastbone or make an incision in the side of your chest to get to your aorta.
- They will place clamps on the aorta to stop blood from flowing through.
- Then, they will replace the bulging/weakened part of the aorta with a prosthesis made of synthetic fabric material (known as a tube **graft**) that is sutured into place. If there are problems with other parts of the aorta, its branches, or the heart valves, these can also be fixed during open surgery.
- The doctor might need to stop your heart for a short time and place you on cardiopulmonary bypass (also called the "heart-lung machine"). This machine takes over the work of your heart while the aorta is being fixed. The machine keeps blood flowing throughout your body. After the graft is in place, the doctor restarts your heart, remove the clamps, and blood flows normally through the graft.
- If work is being done on the aortic arch, blood flow to your brain may be stopped for a short period of time. Your brain is protected by cooling the body during surgery and helps reduce the risk of stroke or brain damage (called deep circulatory hypothermic arrest).
- The doctor will close the incision with skin glue and either cover with clean bandages or leave open to air
- This procedure often takes 6-8 hours, sometimes longer

- Types of Open Thoracic Aortic Surgery are discussed on page 19
- Risks of Surgery are discussed on page 25
- Post-Operative Care is discussed on page 29

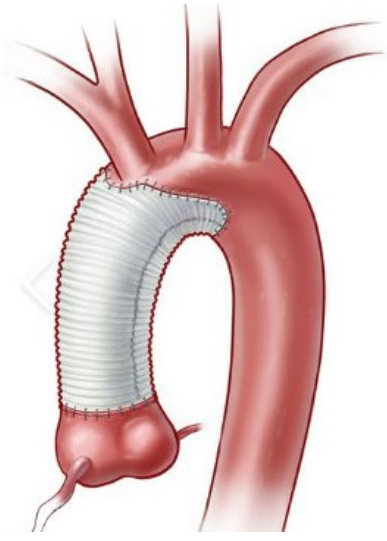
How Are Aneurysms Repaired?

Thoracic Aortic Aneurysm (TAA) - Open Surgery

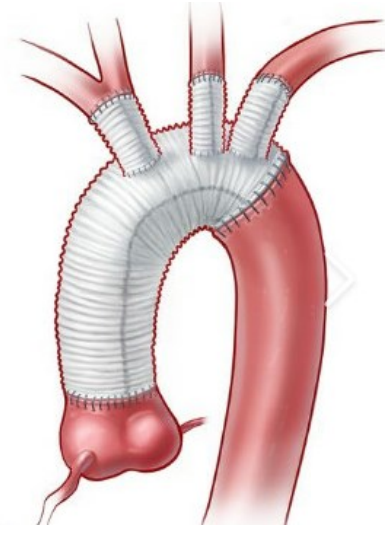
Types of Open Thoracic Aortic Surgery



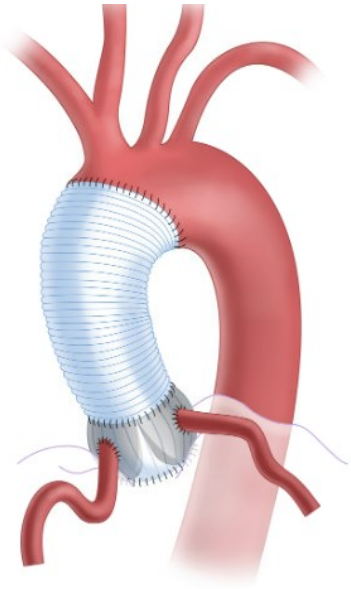
ASCENDING AORTIC REPLACEMENT



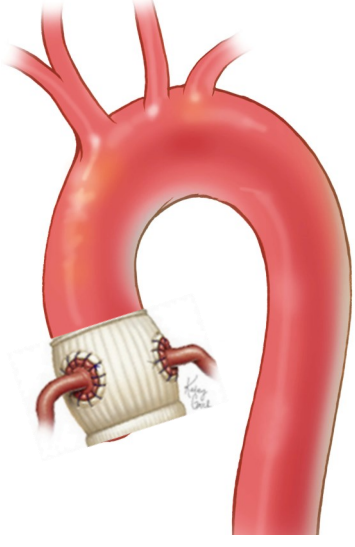
ASCENDING AND HEMIARCH REPLACEMENT:
Ascending aortic replacement with extension in the lesser curve of the aortic arch



TOTAL ARCH REPLACEMENT:
Ascending aortic replacement and reconstruction of the aortic arch vessels (branches)



DAVID PROCEDURE:
Aortic valve-sparing aortic root replacement & ascending aortic repair with coronary artery reimplantation (preserves the patient's own aortic valve)



AORTIC ROOT REPLACEMENT

BENTALL PROCEDURE:
A composite graft replacement of the aortic valve (with a prosthetic valve: mechanical or biological), the aortic root and the ascending aorta, with coronary artery reimplantation

How Are Aneurysms Repaired?

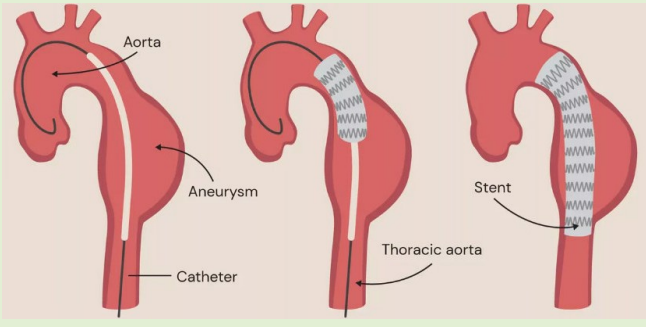
Thoracic Aortic Aneurysm (TAA) - Endovascular Surgery

It depends on location and size of your aneurysm. It also depends on your age, health, and other medical conditions.

- **Aortic anatomy, extent of the disease,** and **available landing zones** (where the graft will land) dictate whether endovascular aortic repair can be performed.
- Patients with bad peripheral arterial disease (unable to obtain artery access in the legs and arms) may not be able to have an endovascular repair.
- *Aortic anatomy is evaluated using imaging such as CT scan or MRI.*

Thoracic Endovascular Stent-Graft

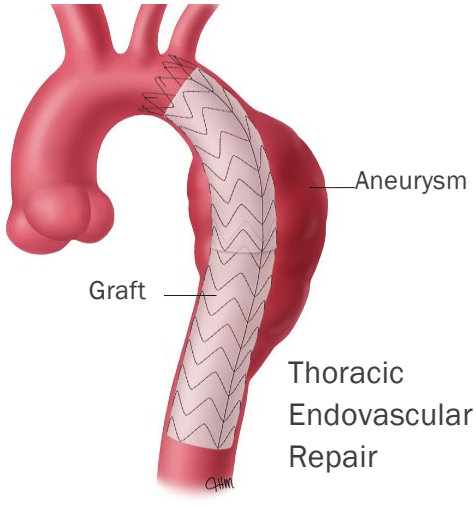
If your TAA is in the aortic arch or descending thoracic aorta (the part that goes toward the abdomen), you might be able to have a **thoracic endovascular aneurysm repair (TEVAR)**



- The doctor makes an incision in a blood vessel in your groin and inserts a folded graft.
- Then threads the graft up to the damaged or dilated part of the aorta and unfolds it.
- This type of graft does not need to be sewn into place.
- Blood flows through the graft instead of the dilated aorta, which decreases the stress on the aortic wall (and prevents rupture).
- The doctor will close your incisions(s) and cover them with clean bandages.
- This procedure often takes 2-4 hours and is performed under general anesthesia.

Preoperative Preparation

- **Measures to prevent kidney injury–** contrast given through the blood vessel is used during the procedure to look at your aorta. Contrast can be toxic to kidneys, especially those with existing kidney disease. Your team will perform prophylactic measures to protect your kidneys (ex. Hydration, lower contrast dosing, identifying those patients at risk, etc)
- **Minimizing spinal cord injury–** if the stent graft covers a large portion of the aorta, you might be more at risk for spinal cord ischemia (decreased blood flow to the spinal cord) which can lead to paralysis. Your team may decide to insert a spinal drain in the operating room to help prevent this.



Thoracic Endovascular Repair

- Risks of Surgery are discussed on page 25 & 26
- Post-Operative Care is discussed on page 27

If a patient is receiving endovascular repair of their thoracic aorta, they MUST comply with required follow up surveillance (see page 24 & 27 for more information.)

How Are Aneurysms Repaired?

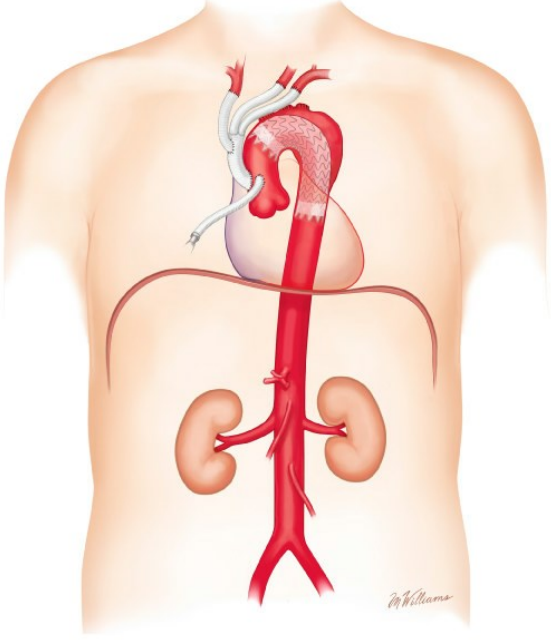
Thoracic Aortic Aneurysm (TAA) - Hybrid Surgery

It depends on location and size of your aneurysm. It also depends on your age, health, and other medical conditions. **Aortic anatomy, extent of the disease,** and **available landing zones** (where the graft will land) dictate whether endovascular repair can be performed.

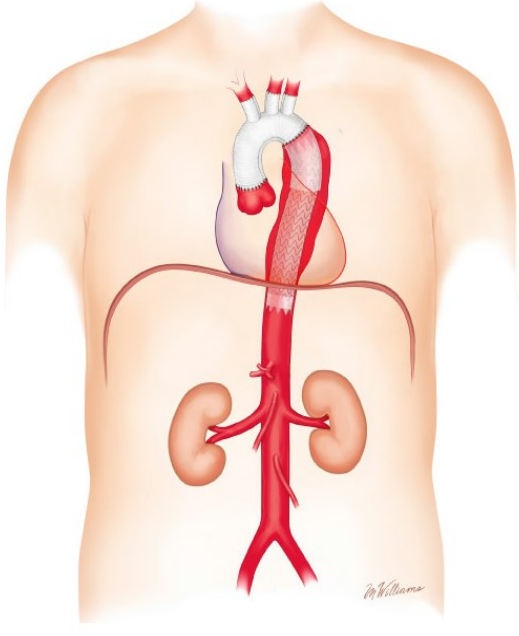
Combination (or "Hybrid") Repair – This involves **open thoracic aortic surgery** followed by an **endovascular graft**. It is usually used if your aneurysm is located in the ascending aorta or the aortic arch. Hybrid repair is performed in stages.

- The first stage uses an "open" approach (incision through the chest/breastbone):
  - The dilated section of the aorta is replaced with a prosthesis made of synthetic fabric material (known as a tube **graft**) that is sutured into place.
  - Or a **"de-branching"** procedure is performed with the goal is to bypass critical vessels supplying the brain and arms, giving room for the stent graft to land safely.
- The second stage is to deploy a stent graft **(TEVAR)** in the disease portion of the aorta (the aneurysm), to seal off blood flow to the weakened blood vessel walls.

Most of the time, this is performed in **two separate procedures**, but in special cases it can be performed by the cardiothoracic and vascular surgeon in special operating rooms at the same time.



The arch vessels are **debranched**, which provides adequate tissue and area for a stent-graft to land in the ascending aorta.



Open "Elephant Trunk" Repair (type of surgery): When the ascending aorta and branch vessels are replaced, followed by endovascular stent-graft repair of the descending thoracic aorta. The stent is landed into the new tube graft.

- Risks of Surgery are discussed on page 25
- Post-Operative Care is discussed on page 27 & 29

How Are Aneurysms Repaired?

Abdominal Aortic Aneurysm (AAA) - Open Repair

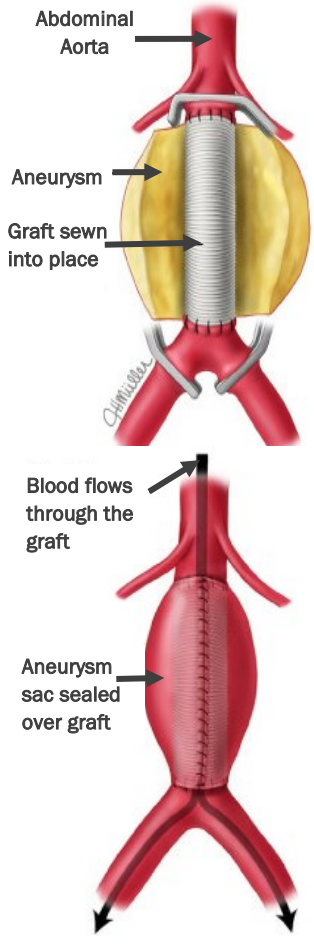
It depends on location and size of your aneurysm. It also depends on your age, health, and other medical conditions.

Open abdominal aortic repair refers to surgery in the abdomen that involves replacing the diseased segment of the aorta (such as an **aneurysm, dissection**, etc) with a prosthesis made of fabric material (known as a **graft**) that is sutured into place. This allows blood to flow normally and excludes the weakened aortic wall and prevents rupture.

- In general this is for younger/healthier people, those with connective tissue diseases, and those in whom a stent-graft will not fit properly may be offered open surgery.
- Aortic anatomy is evaluated using imaging such as CT scan or MRI.

Procedure

- This procedure is performed under general anesthesia.
- You may be given an epidural to help with post-op pain.
- The surgeon makes a cut or "incision" in the skin of the abdomen and directly visualizes the aorta. The incision will either be in the middle, across or on the side of the belly.
- Then the surgeon will clamp the aorta above and below the diseased segment.
- Your surgeon will open the aortic wall/aneurysm, sew a graft into the bulging part, and then close the aneurysm wall over the graft. This reinforces the aortic walls
- The aneurysm is not removed, rather the it is replaced with a prosthesis made of manmade material (also known as a **graft**) that is stitched into place.
- They will remove the clamps, and blood flows normally through the graft.
- The doctor will close the incision with sutures, staples, or skin glue and cover with clean bandages
- This procedure often takes 3-6 hours, sometimes longer
- After surgery, the patient is taken to the intensive care unit for monitoring.



- Risks of Surgery are discussed on page 25
- Post Operative Care is discussed on page 28

How Are Aneurysms Repaired?

Abdominal Aortic Aneurysm (AAA) - Endovascular Surgery

It depends on location and size of your aneurysm. It also depends on your age, health, and other medical conditions.

- **Aortic anatomy, extent of the disease,** and **available landing zones** (where the graft will land) dictate whether endovascular aortic repair can be performed.
- Patients with bad peripheral arterial disease (unable to obtain artery access in the legs and arms) may not be able to have an endovascular repair.
- *Aortic anatomy is evaluated using imaging such as CT scan.*

Endovascular Stent-Graft

An endovascular aneurysm repair (EVAR) is a less invasive surgical procedure.

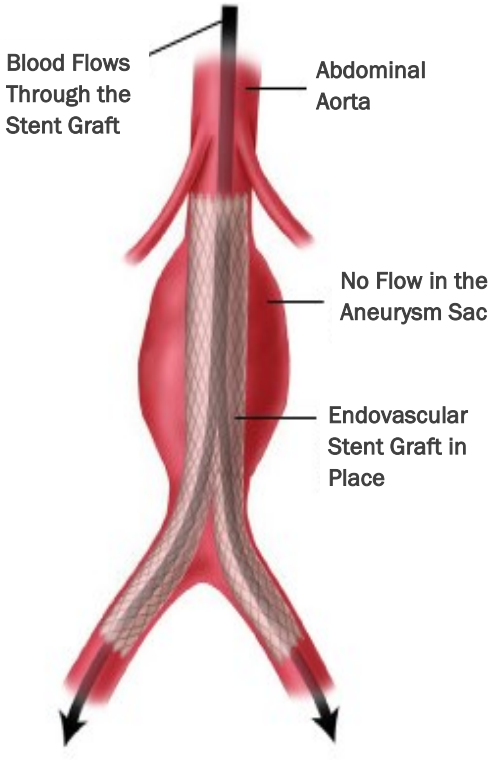
- Performed under general anesthesia.
- The doctor makes an incision(s) into a blood vessel in your groin, inserts a thin tube, and dye is injected to guide placement of a stent graft.
- Then the doctor inserts the folded graft and uses x-ray to guide the graft up to the bulging or weakened part of the aorta (AAA) and unfolds it. This reinforces the aortic walls.
- This type of graft does not need to be sewn into place. Blood flows through the graft instead of the dilated or weakened aorta, which decreases the stress on the aortic wall.
- The doctor will close your incision(s) and covers them with clean bandages
- This procedure often takes 2-4 hours.

Preoperative Preparation-

- **Measures to prevent kidney injury**– contrast given through the blood vessel is used during the procedure to look at your aorta. Contrast can be toxic to kidneys, especially those with existing kidney disease. Your team will perform prophylactic measures to protect your kidneys (ex. Hydration, lower contrast dosing, identifying those patients at risk, etc)

Stent-grafts have become the <u>primary mode of treatment</u>, with approximately 80% of AAAs being able to be repaired with an EVAR.

- Younger people, those with connective tissue diseases, and those in whom a stent-graft will not fit properly may be offered open surgery.



- Risks to surgery are discussed on page 25 & 26
- Post-Operative Care is discussed on page 27

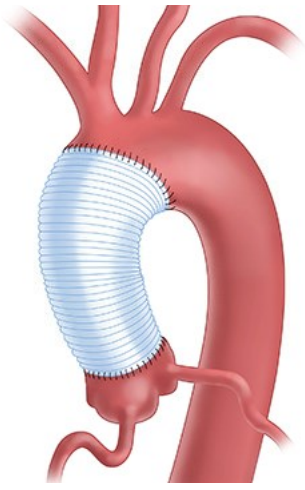
**If a patient is receiving endovascular repair of their abdominal aorta, they <u>MUST</u> comply with required follow up surveillance* (see page 24 & 27 for more information.)

How to Choose What Kind of Repair

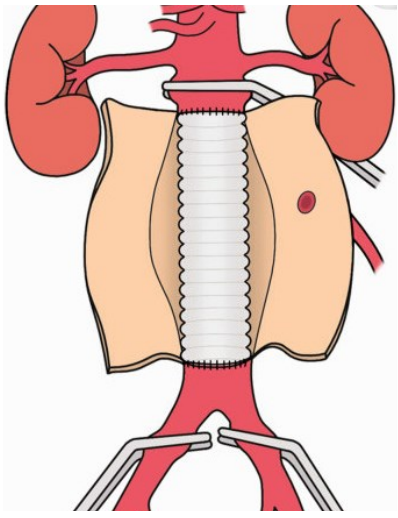
Open Surgery

Is riskier in the short term; but it fixes the aneurysm for good. Recovery from surgery is much longer, and patients are generally able to go home after four to seven days with activity restrictions for weeks—depending on surgeon's direction.

- This option is usually reserved for: younger and healthier patients, those with connective tissue diseases, or those with incompatible anatomy for an endovascular stent.



Ascending aortic replacement



Open AAA Repair

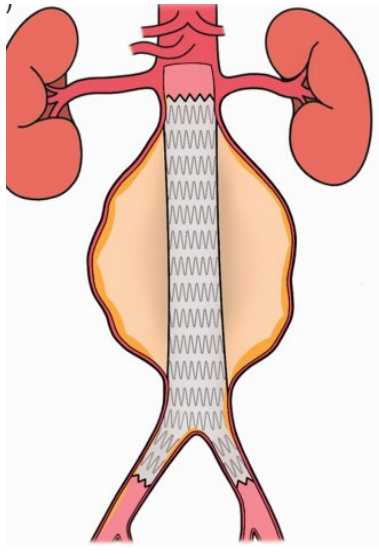
Endovascular Surgery

Is a less invasive surgery and is less risky in the short term. Typically, patients stay in the hospital for 1-3 days and can return to normal activities sooner.

- Your doctor will need to monitor you **for life** (involves regular imaging). Endovascular grafts sometimes slip out of place and need to be fixed. (Fixing them usually involves a simpler procedure than the first surgery). Sometimes there can be continued blood flow within an aneurysm sac after it's been sealed (called an **endoleak**). This can lead to further expansion of your aorta.

Endoleak is discussed on page 26

TEVAR



EVAR

Your surgeon will discuss the options. You should ask:

- How large is my aneurysm, and how quickly is it growing?
- What are the risks of each procedure for me? Is it safe to keep monitoring?
- What kind of follow-up will I need with each option?
- What is likely to happen if I do not have treatment?

Risks of Aortic Aneurysm Repair

Although complications associated with aortic repair are minimized, every surgery carries a certain degree of risk. The doctor will also take into account your existing health problems when deciding for or against surgery. Your surgeon will talk to you and your family about all of the possible risks and answer your questions.

Endovascular Surgery Risks

- Endoleak or improper seal (discussed on page 26)
  - Need for additional procedures
- Vascular injury at the access site or where the stent is deployed (causes dissection or rupture)
- Migration or movement of stent
- Blood clots or bleeding
- Ischemia (reduced blood flow) to organs or limbs
- Paralysis can happen during TEVAR
- Infection

Open Aortic Surgery Risks

- Blood clots or bleeding
- Ischemia (reduced blood flow) to organs or limbs
- Stroke (THORACIC SURGERY)
- Paralysis (THORACIC SURGERY)
- Damage to organs
- GI Complications (ABDOMINAL SURGERY)
- Kidney or lung problems
- Infection
- Heart failure, heart attack, irregular rhythm
- Need for reoperation
- Death

Endoleak - After Endovascular Surgery

- An endoleak is defined as the persistence of blood flow outside an endovascular stent–graft, but within the aneurysm sac. There are five main types of endoleaks to be aware of *(see below)*.
- The main danger of endoleaks is rupture of aorta

Types of Endoleaks

Type I: blood flowing into the aneurysm sac because of an incomplete/ineffective seal

-**Type Ia:** incomplete seal at the top of the graft

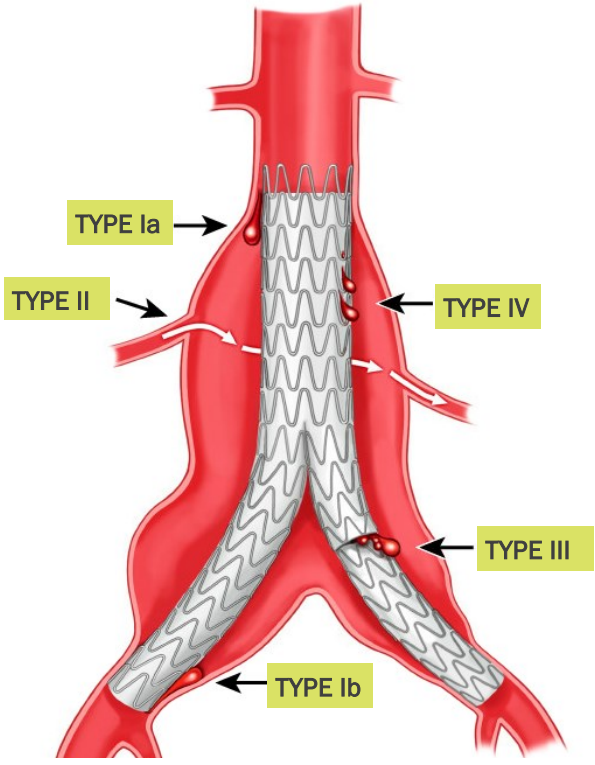
-**Type Ib:** incomplete seal at the bottom of the graft

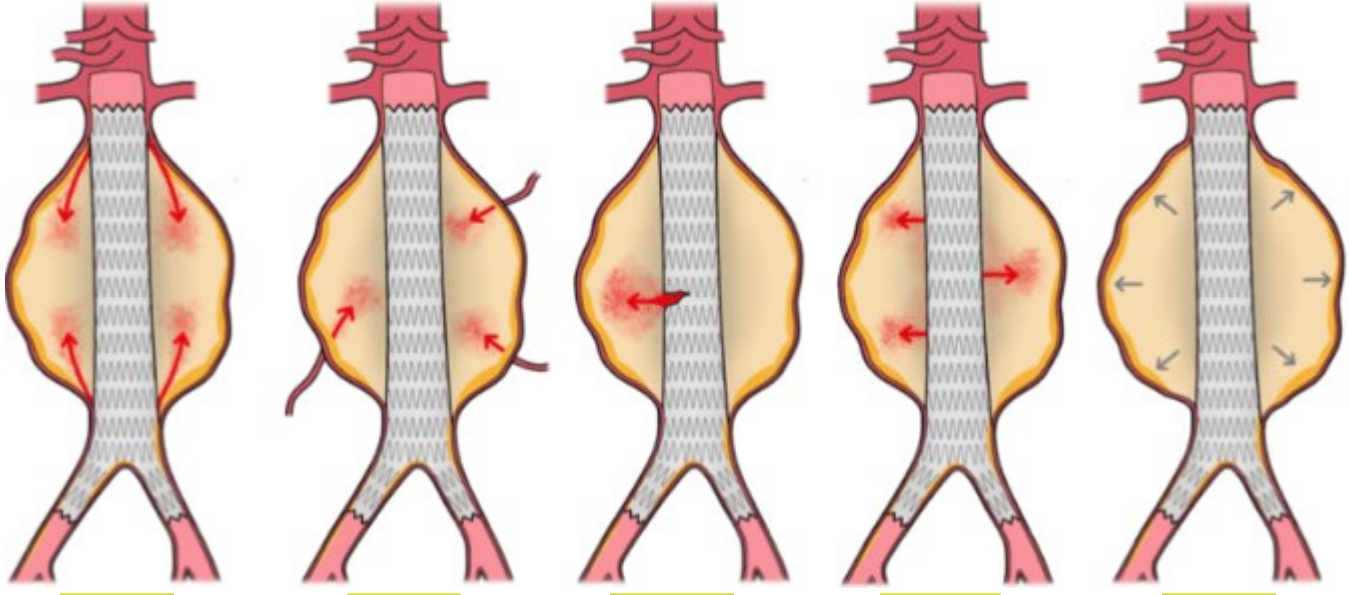
Type II: **Most common—**retrograde (backward) blood flow into the aneurysm sac from side arterial blood vessel branches (most common are from lumbar arteries or the inferior mesenteric artery)

Type III: blood flowing into the aneurysm sac through a fabric defect in the endograft or between separate graft components

Type IV: blood flowing into the aneurysm sac through the stent–graft fabric (porous)

Type V: Aneurysm sac expansion without radiographic evidence of a leak site (also known as “endotension”)





Postoperative Care After Surgery

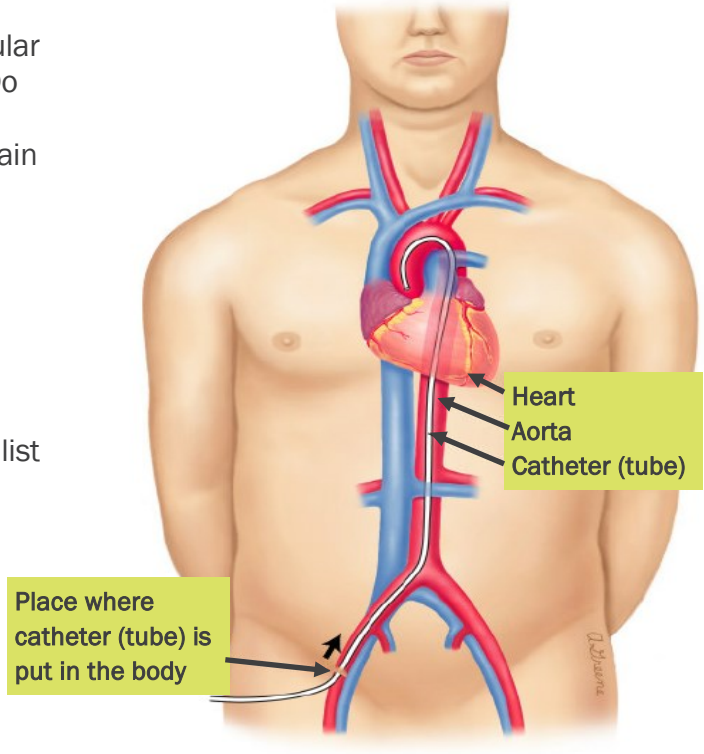
Endovascular Aortic Surgery

- Usually, patients can be transferred to a regular floor once they have recovered from anesthesia, unless closer monitoring is needed where they may have a short stay in the Intensive Care Unit (ICU). If you have a spinal drain (sometimes placed with TEVARs) you will go to the ICU. You may feel groggy or confused at first, this will improve with time.
- Your team will often check your pulses and your strength at regular times and compare them to your baseline pre-op examination.

Diet: you will drink clear fluids and advance to a regular diet, as tolerated. Consume a cardiac friendly diet. Do not skip meals. Do not consume alcohol for the first week after surgery or while taking any prescription pain medications.

Pain: You will receive different kinds of pain medications to control your surgical pain. Most patients do not need strong pain meds after endovascular aortic surgery.

Medications: it is important to take newly prescribed medications EXACTLY as prescribed. Keep a current list of your medicines, dosages, and times to be taken. Common medications after aortic surgery: blood pressure medications, aspirin, cholesterol medication. Other medications can include: diuretics "water pills", blood thinners, and stool softeners. Please see page 33 for information on medication management.



Activity: Walking is resumed on the first postoperative day. Slowly increase your activity. Do not lift heavy objects (more than 10lbs) or engage in strenuous activity/exercise for at least two weeks.

Surgical Incision: Your incision(s) will be in your groin area (with TEVAR you may have an incision in your left wrist), and it is necessary to keep them dry and clean to avoid infection. Typically your incision will be closed with skin glue. Occasionally there may be staples or sutures if the incision is bigger. Incision care is addressed on page 32

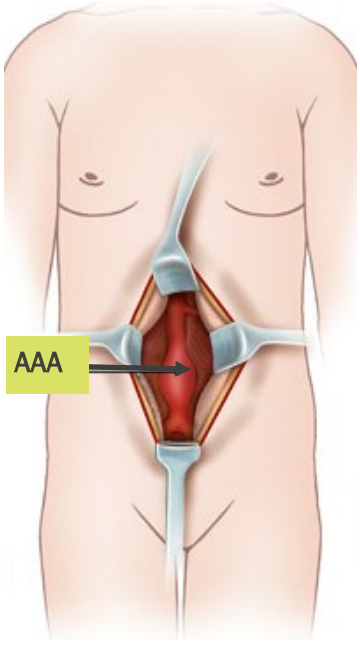
Discharge: Most patients are discharged home within 1-2 days following endovascular repair. You will be encouraged to drink plenty of fluids after surgery to minimize the risk of kidney injury after the use of contrast during your procedure. Please monitor your blood pressure with a home blood pressure cuff. Keep a log of these readings 3 times a day and review with your primary care provider. Please attend any scheduled post-op appointments and imaging. Your surgeon will want to see you about 1 month after surgery in clinic with a CT scan.

Endograft Surveillance: Routine surveillance is MANDATORY to assure the integrity of the repair. You may not feel if a malfunction with the stent is present. We suggest that surveillance should be performed at 1 month and then yearly thereafter for uncomplicated repairs to prevent late problems.

Postoperative Care After Surgery

Open Abdominal Aortic Surgery

- Patients are usually taken to the intensive care unit (ICU) for monitoring after surgery.
- You might feel groggy or confused for a short time. You might also feel nauseous or vomit. The doctor or nurse can give you medicine to help with this. You will have a tube in your nose and a bladder catheter, it will be removed sometime in the next few days.
- Your team will often check you pulses at regular times and compare that to your baseline pre-op examination.



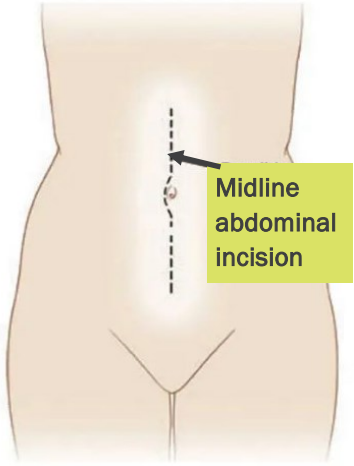
Diet: You will not be able to eat or drink until you have return of bowel function, which can take days to return. When you are ready to eat, you will start with clear liquids. Then, you can start eating as you are able. You might feel better if you start with bland foods. Consume a cardiac friendly diet.

Pain: You will receive different kinds of pain medications to control your surgical pain. Some patients receive an epidural to help with pain in the operating room.

Medications: You will resume many your usual medications post-op once you have return of bowel function. It is important to take newly prescribed medications EXACTLY as prescribed. Keep a current list of your medicines, dosages, and times to be taken. Common medications after aortic surgery: blood pressure medications, aspirin, cholesterol medication. Other medications can include: diuretics "water pills", blood thinners, and stool softeners. Please see page 33 for information on medication management.

Activity: The staff will help you get out of bed and start moving around early in your recovery.

- Walking is resumed 1-2 days after surgery. Slowly increase your activity.
- You can expect that your energy level will be reduced for about 8 weeks.
- Going up stairs is okay, just go slowly.
- Do not lift anything heavier than 10 pounds (the weight of a gallon of milk) for about 6 weeks. This may be extended based on the extent of your dissection.
- No strenuous activities
- No driving following your surgery until you are completely healed and have follow up appointment with your surgeon.



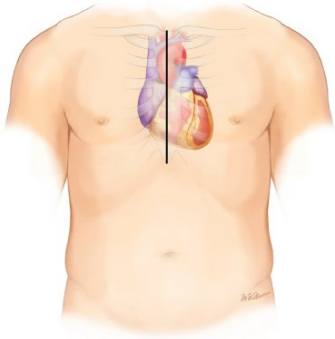
Surgical Incision: You might have stitches, staples, or skin glue. Directions will be given by your team at the time of discharge. Incision care is addressed on page 32

Discharge: The majority of patients can be discharged home within a week after surgery. Continue to wear TED compression/stockings on your legs daily. You can remove these at night. Please monitor your blood pressure with a home blood pressure cuff. Keep a log of these readings 3 times a day and review with your primary care provider. Please attend any scheduled post op appointments and imaging. Your surgeon will want to see you about 1 month after surgery in clinic.

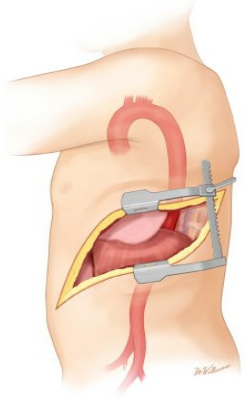
Surveillance: Usually patients have a scan 1 year after surgery and every 5 years thereafter for uncomplicated repairs.

Postoperative Care After Surgery

Open Thoracic Aortic Surgery



Sternotomy -opening the breast bone



Thoracotomy - opening the side of the chest between the ribs *(rare)*

- Patients go to the intensive care unit (ICU) for monitoring after surgery. You might feel groggy or confused for a short time.
- You will have a breathing tube, and this will be removed in the ICU as soon as it is safe. You will have a bladder catheter, chest tubes and pacing wires coming out of your chest. These will all be removed over the next few days.

Diet: You will drink clear fluids and advance to a regular diet, slowly as tolerated. Consume a heart healthy diet.

Pain: You will receive different kinds of pain medications post-op to control your surgical pain.

Medications: It is important to take newly prescribed medications EXACTLY as prescribed. Keep a current list of your medicines, dosages, and times to be taken. Common medications after aortic surgery: blood pressure medications, aspirin, cholesterol medication. Other medications can include: diuretics "water pills", blood thinners, and stool softeners. See page 33 for information on medication management.

Activity: The staff will help you get out of bed and start moving around early.

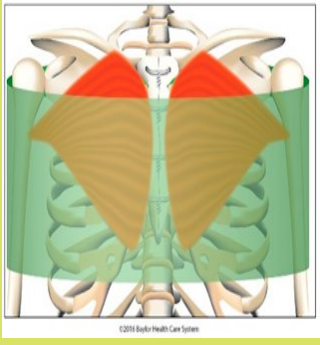
- Walking is resumed 1 day after surgery. Slowly increase your activity.
- You can expect that your energy level will be reduced.
- Going up stairs is okay, just go slowly.
- Sternotomy incision - "Keep Your Move In The Tube" (see below)
  - ◊ Surgical bra for females
- Thoracotomy - 10lb weight restriction on the side of the surgery for 2 weeks
- No driving following your surgery for 4 weeks.

Surgical Incision: Typically, the incision is closed by skin glue/stitches. Incision care is addressed on page 32

Discharge: The majority of patients can be discharged home within 5-7 days after surgery. Continue to wear TED compression/stockings on your legs daily. You can remove these at night.

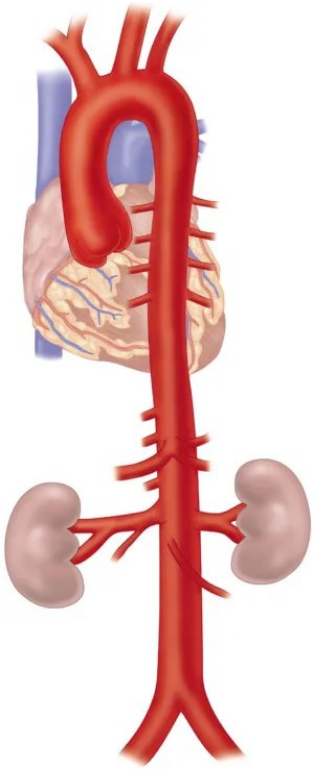
Surveillance: Patients have a CT scan within 1 year after repair, with stretched out intervals thereafter. It also depends on if there is still an unrepaired/diseased section of the aorta.

KYMITT
(Keep Your Move In the Tube)



Imagine a tube around your upper body. During weight-bearing activities (like getting out of bed, lifting, or pushing), keep both arms inside this tube.

- **Weight-bearing activities:** Keep arms close to the body, avoiding stretching across the chest or using chest muscles in a way that would stress the sternum.
- **Non-weight-bearing activities:** Patients are allowed freedom of movement during activities like hygiene, toileting, and bathing, as long as it's pain-free.
- **Pain as a guide:** Pain and discomfort should be used as a guide for safe limits of movement.
- Brace your chest with a pillow/arms when coughing/sneezing/laughing.
- Sleeping on either side or on your back is permitted. DO NOT sleep on your stomach.



More General Information

- Symptoms Needing Attention
- Care of Your Incision - After Surgery
- Medication Information - After Surgery
- Heart Healthy Diet

Symptoms Needing Attention

Needs Immediate Attention Go to the Emergency Room or Call 911!	Urgent Problems Call a Doctor/Clinic	Non-Urgent Issues Call the clinic nurse, Care Coordinator, Case manager

▶ Feel short of breath or have trouble breathing, not relieved by rest
▶ Have sharp or severe chest pain when you breathe
▶ Are coughing up blood
▶ Sustained chills and fever
▶ Severe abdominal pain
▶ Uncontrollable bleeding
▶ Fast or irregular heartbeat
▶ Have signs of stroke, like sudden:
  ▶ Numbness or weakness of the face, arm, or leg, especially on 1 side of the body
  ▶ Confusion, or trouble speaking or understanding
  ▶ Trouble seeing in 1 or both eyes
  ▶ Trouble walking, dizziness, or loss of balance or coordination
  ▶ Severe headache
▶ Have signs of a heart attack—Severe chest pain, pressure, or discomfort with:
  ▶ Breathing trouble, sweating, upset stomach, or cold and clammy skin
  ▶ Pain in your arms, back, or jaw
  ▶ Worse pain with activity like going up stairs
	▶ Elevated temperature more than 100.4°F (38°C) two times in 24 hours
	▶ Extreme fatigue, feeling dizzy, faint or weak
	▶ Worsening shortness of breath
	▶ Persistent but controllable bleeding/oozing/drainage from your incisions
	▶ Bright red stool
	▶ New onset of nausea, vomiting, or diarrhea
	▶ Signs of infection: redness, drainage, or swelling around incisions
	▶ Pain or tightness in the calf that gets worse when pointing toe up to head
	▶ Sharp pain when taking a deep breath
	▶ Skin rash
	▶ Have a urinary tract infection
	▶ Weight gain of more than 1-2lbs in 24 hours
	▶ Worsening ankle swelling or leg pain
		▶ Directions for incisional care
		▶ Questions about your post-operative recovery
		▶ Questions about discharge instructions
		▶ Questions about your surgery
		▶ Management of stable symptoms
		▶ Home health care
		▶ Helpful community services or agencies

Care of Your Incision After Surgery

Preventing Infection

Keep your incision **dry.**

Once you no longer need to keep your incision dry, **shower daily** with a gentle soap allowing the shower water to rinse off the soap. Water from the shower may directly hit your incisions. Make sure to gently pat incisions completely dry with a clean towel.

Do not use perfumed soaps or body washes.

Do not submerge fresh incisions in a bath or pool, this can cause infection.

Avoid vigorously scrubbing the incision. Do not pick at scabs or the incisional glue.

Incisions can sunburn easily, be sure to protect them from overexposure to sunlight during the first year after surgery. The scar will become darker after prolonged exposed to the sun.

Do not apply lotions, creams, oils or powders to your incision unless prescribed by your doctor.

Be compliant with your weight and activity restrictions. If you over-exert yourself you can cause damage to your incision.

Check your temperature twice a day for two weeks

Check your incisions every day. Mild redness and or bruising at the incision site is normal. If you have home health or a visiting nurse after surgery have them look at your incisions.

Call your doctor if :

- There is drainage from the incision
- Increased redness or swelling around the edges of your incision, or if the edges separate.
- Increased tenderness
- A persistent fever—could indicate infection

Medication Information

Your doctor will prescribe medications when you are discharged from the hospital.
Sometimes these medications will be sent electronically to your pharmacy, or you will receive a paper prescription.

Take your prescribed medications EXACTLY as prescribed. Keep a current list of your medicines, dosages, and times to be taken in your wallet or purse.

You will usually resume your medications after surgery, HOWEVER if you need to **HOLD** or **STOP** one or more of your current medications you will be instructed to do so and have close follow up with your primary care provider, cardiologist and surgeon about when to resume.

Do not take other medications, supplements, or herbal preparations without telling your doctor. These can have interactions with your medications.

Medications you may be prescribed or instructed to take (you may not need all of these):

Blood pressure medications– make sure to monitor you blood pressure at home, good control is essential for those with aortic disease. Keep a log to give to your PCP or cardiologist.

- Beta blockers like "metoprolol" keep your heart strong after surgery and reduce the risk of heart arrythmias. They are also used to control heart rate and reduce stress on the blood vessel wall.
- There may be other classes of medication used to help keep your blood pressure in a safe range.

Aspirin – you will most likely be on this medication lifelong. Aspirin reduces the risk of cardiac events.

Cholesterol Medication – Most patients go home with a "statin" to help keep their cholesterol under control, it can provide patients with vascular disease with positive cardiac effects

Diuretic ("water pill") – to help decrease swelling/ water retention after surgery

Blood thinners – some patients go home on blood thinners (ex. Warfarin, Eliquis), sometimes for life or a short time as instructed by their provider.

Stool Softeners– helps prevent constipation and helps prevent straining

Heart-Healthy Eating Plan

What you eat makes a difference to your heart. A heart-healthy eating plan emphasizes vegetables, fruits, and whole grains, includes fat-free or low-fat dairy products, and limits foods high in saturated fat and sugar-sweetened beverages and sweets. Use the guide below to determine how much you should eat from each food group.*

Food Group	Heart-Healthy Options
 **Whole Grains** Bread, cereal, starchy vegetables, rice, and pasta (6 ounces for women and 8 ounces for men)	♥ Whole grain versions of sliced bread, sandwich buns, dinner rolls, pita, English muffins, bagels ♥ Unsalted, low-fat crackers (such as graham crackers), pretzels, and popcorn ♥ Cooked hot cereals (not instant) and whole grain cold cereals ♥ Rice and pasta (such as whole grain noodles, spaghetti, and macaroni)
 **Vegetables** (without added fat) (2½ cups)	♥ Fresh, frozen, or no-salt-added canned vegetables (such as green beans, string beans, carrots, cabbage, tomatoes, squash, broccoli, and okra)
 **Fruits** (2 cups)	♥ Fresh, frozen, canned (in fruit juice rather than syrup), or dried fruits
 **Fat-free or low-fat milk and milk products** Milk, yogurt, and cheese (3 cups)	♥ Fat-free or low-fat (1 percent) milk ♥ Fat-free or low-fat yogurt ♥ Cheeses lower in fat and sodium
 **Protein** Meat, poultry, fish, eggs, nuts, seeds, and legumes (5½ ounces)	♥ Chicken or turkey without the skin ♥ Fish ♥ Lean cuts of beef, such as round, sirloin, chuck, loin, and extra-lean ground beef ♥ Lean cuts of pork, such as the leg, shoulder, tenderloin, and lean ham ♥ Eggs ♥ Cooked dry beans and peas (such as field peas, crowder peas, black-eyed peas) ♥ Frozen butter beans and lima beans ♥ Nuts and seeds
 **Fats and oils** (less than 22 grams of saturated fat)	♥ Soft tub margarine ♥ Oils (canola, corn, safflower, olive, peanut, or sesame)
 **Sweets and added sugars** Limit sugar and other sweeteners. Ask your healthcare provider about how much sugar or other sweetener is okay for you.	♥ Frozen desserts (such as frozen juice pops, low-fat frozen yogurt, or low-fat ice cream) ♥ Low-fat cake and cookies (such as angel food cake, fig bar cookies, ginger snaps, animal crackers, vanilla wafers, and graham crackers)

***Serving sizes** depend on how many calories you need, which is based on your age, gender, and physical activity.

NIH National Heart, Lung, and Blood Institute THE heart TRUTH

hearttruth.gov

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