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Dear Patient and Family,

Welcome to the Robert Wood Johnson University Hospital Division of Cardiothoracic Surgery (CTS). It is our hope that this handbook will provide you with a comprehensive overview of what to expect during your stay at the hospital.

Please utilize this to answer many of the questions you and your family may have. It will be helpful to you and your family to write down any question or concerns you may have to you can refer to them as needed. You and your family will be meeting many members of the CTS team. Our multidisciplinary team will be caring for you throughout your entire hospital stay. There are many components to our team, each providing a valuable service in an effort to make your hospital stay comfortable.

There is a member of the team present in the hospital 7 days a week, 24 hours a day. If at any time you have a question or concern, please do not hesitate to ask your nurse to contact us.

Cardiothoracic Surgeons

Leonard Lee, MD
Professor of Surgery
James W. Mackenzie, M.D. Endowed Chair
Chair, Department of Surgery
Advanced Practice Providers:

Working closely with your surgeon is a team of Advanced Practice Providers (APPs). There are two types of APPs on this service, both performing the same job. They are Nurse Practitioners and Physician Assistants. The CTS APPs are highly trained by the surgeons within this specialty and work as the eyes and ears of your surgeon. You will be cared for by the APPs before surgery (pre-operatively), and after surgery (post-operatively). The surgeons and APPs will be collaborating with other specialists and making decisions regarding your care.

Clinical Coordinators:

The CTS Clinical Coordinators are Nurse Practitioners that will work closely with you and your family during the pre-operative and post-operative period. Our coordinators will assist you with ensuring that your pre-operative work up and discharge from the hospital is smooth and will see you upon your first follow up appointment. The clinical coordinator is your direct contact for any questions you may have.

Registered Nurses:

All of your care, pre-operatively, intra-operatively and post operatively, will be administered by a team of highly skilled RN’s who have undergone specialized training and education specific to Cardiac Surgery.

Respiratory Therapist:

To assure superior respiratory care and for post-operative respiratory management the respiratory therapists will assist you in performing deep breathing exercises appropriately, administering nebulizers and inhalants as ordered and will coordinate management with the Cardiac Surgeons, APP’s and RN’s.

Physical Therapist:

All of our cardiac surgery patients are evaluated by licensed physical therapists after surgery. They assist you in regaining your strength, assessing your level of activity and educate you on the skills needed to return home and back to your routine activities. Physical therapists also assist you in assessing your need for rehab before returning home.
**Case Managers and Social Services:**

Every patient is assigned a case manager in the hospital. They are trained professionals available to assist you with arrangements for recovery at home including medical equipment, physician orders, and financial concerns.

A licensed social worker is also available to assist you in making arrangements for in-patient rehabilitation and extended care facilities. Feel free to ask your nurse if you wish to speak with a case manager or a social worker.

**Pastoral Care:**

A clinically trained Chaplain is available 24/7/365 for emotional and spiritual support. Chaplains focus on patients and their families’ own spiritual and religious resources, offering a comforting presence and a listening ear. On-site chaplains are available for Communion, anointing, blessings, emergencies, Eucharistic visitations, memorials, debriefings and various holiday services. Assistance with and education about Advance Directives is provided as requested.

**Patient Experience:**

At RWJBH we have a dedicated team of patient representatives who are available to assist you on your healthcare journey. Patient Representatives provide a variety of services to RWJUH’s patients and their families. These services include providing information about hospital services, supporting you and your family during times of crisis, providing information about patients' rights and responsibilities, explaining hospital policies and assisting you with any concerns you may have.

A hospital Patient Representative is available by calling (732) 937-8501 or by calling extension 8501.
Before Your Surgery
(Pre-Operative)
Before Your Surgery

Under many circumstances, you may have several days to prepare for your upcoming surgery. It is very important to make the most of this time to assure you are well rested and remain healthy.

The following are some suggestions to best prepare your body for surgery.

- Eat even if you may not feel particularly hungry
- Eat a variety of healthy foods each day
- Try to get enough rest
- Quit smoking and limit alcohol intake

It is important to ensure that your body gets enough vitamins, proteins and other nutrients. A patient with good nutrition will do better in every aspect of the surgical procedure as well as post-operatively. Taking a multivitamin and Vitamin C may be especially helpful. Getting rest is also very important as the more rested you are, the stronger your body will be.

Quit smoking:

This will make a huge difference in your post-surgery recovery. Smoking is harmful to your lungs and heart. It raises your blood pressure and makes the heart work harder. It also produces more mucus in your lungs. Quitting smoking as early as possible can decrease your time spent on the breathing machine (ventilator).

Express your fears, concerns and doubts:

These are very normal feelings to have during this time. Speak with your physicians, Advanced Practice Providers, Clinical Coordinators and nurses who can answer any questions or concerns you may have. You may also want to speak with your family and friends; they can be a great support system for you during this difficult time.

***Contact our Volunteer Caring Hearts support organization; 732-828-3000 ext. 5530.
***Leave your name and phone number and a member will return your call. Each volunteer has undergone open heart surgery and has experienced the feelings and anxieties normally associated with this surgery. They will also visit you at the hospital. You may even consider joining this group once you have fully recovered!

Dental Clearance:
If you are scheduled to undergo heart valve or aneurysm surgery you will need a dental clearance letter from your dentist prior to your surgery. If you have not seen a dentist in the past 6 months you will need to get a pre-operative dental exam. You can have your dentist fax us a clearance letter to 732-235-8963.

The Flu Shot:

If your surgery has been electively scheduled, meaning you are waiting at home for your scheduled surgery, you may have the opportunity to discuss with your primary care doctor whether you are a candidate for the flu and/or pneumonia vaccine. The Cardiac Surgery team recommends that you obtain these vaccinations, if appropriate, at least 2 weeks prior to your upcoming surgery. The flu vaccine usually becomes available in the beginning of October of each year. To be properly protected, you must be vaccinated yearly. The pneumonia shot will prevent you from a potential secondary infection of the flu (Pneumococcal pneumonia). You will be asked on admission to the hospital if you have received these vaccines. If you have not and it is appropriate, the Advanced Practice Providers can order the injections to be given prior to your discharge from the hospital.

Blood Transfusions:

The possibility for blood transfusions during surgery is also a concern for many patients and families. Any blood that you may lose during your surgery is collected through special equipment, filtered, and returned to your circulation. A small percentage of patients will require blood transfusions. Your family members may want to be designated blood donors for you. You may contact our blood center at 732-235-8100 for more information. Donations are by appointment only.

Questions???

If you have any questions before and after your surgery, you may contact one of the Cardiac Surgery Clinical Coordinators Monday thru Friday 8:00 am-4:00 pm.

- Jen Gopez, APN: (908) 239-5492 or Jennifer.Gopez@rwjuh.edu
- Lina Shi, APN: (732) 354-2848 or Lina.Shi@rwjuh.edu
- Christine Savarese, APN: (732) 673-7746 or Christine.Savarese@rwjuh.edu
You may also leave a message on the coordinator’s voicemail. The number to call is (732) 235-6556. Calls left on this number will be returned within 48 hours.

**Please let your surgeon know immediately if your health changes before your surgery. If you develop signs of a cold or the flu (fever, cough, chills, sputum, body aches), or experience any physical changes, please contact your surgeon’s office. **

**Some Questions to Think About Before Your Surgery:**

- **Who will drive me to the hospital? How will I get home?**
  Now is the time to talk to friends if family is not available. When leaving the hospital, if you are going home your family or friends will need to provide transportation. If you will be going to a rehabilitation facility (rehab) a social worker will see you in the hospital after surgery to arrange your transportation.

- **Who will be at home with me during my recuperation?**
  If family and friends will not be available, think about going to an inpatient rehabilitation facility upon discharge. The surgical team recommends having someone at home with you for at least one week after discharge.

- **What rehabilitation facilities are available to me?**
  A social worker will provide you and your family with a list of rehabilitation facilities that take you insurance and are in the area you desire.

- **How do I get information about creating a living will or health care proxy?**
  If you require assistance, call the Chaplain’s office at (732) 937-8504

**Pre-Operative Testing:**

There is routine preoperative testing that is required prior to your surgery. If you are at home, you will be asked to come in the hospital for pre-admission testing (PAT’S). The Cardiothoracic Surgery Clinical Coordinators will schedule you for your PAT’S. If you are in the hospital, these tests will be ordered by your Physician or Advanced Practice Provider and done during your hospital stay prior to your surgery date.

The following are routine preoperative testing that will be performed:

- Blood work
• Urinalysis (urine test)
• Blood Type and screen
• Arterial Blood Gas: blood is drawn to check the oxygen levels in your blood
• HgbA1C (sugar levels)
• Lipid profile (cholesterol levels)
• Chest X-Ray
• EKG
• Spirometry: this is a special type of breathing test
• Carotid Doppler (scan of your carotid arteries)
• Vein Mapping (if you are having a CABG, this test shows us the size of the veins in your legs)
• Echo (ultrasound of your heart)
• CT Chest (if previous open heart surgery or if indicated by your surgeon)

Preoperative Medications:

Here is some information about the medications that you are taking now as well as medications you will need to take prior to your surgery.

***Do not stop any medicine unless told to do so***

General Guidelines:

1. If you are taking any of the following medications please contact your cardiologist to find out when you need to stop taking these medications prior to surgery:
   • Plavix and have not had any stents placed over the past year, you may be directed to stop this medication 5 days before surgery.
   • Ticagrelor (Brilinta) , Effient (Prasugrel), Pradaxa or Xarelto (Rivaroxaban).
   • Aspirin 325mg, you will need to change to 81 mg daily, 5 days before surgery.
   • Coumadin, you will need to stop the Coumadin 5 days before surgery. Please contact your cardiologist or doctor who is monitoring your Coumadin to see about their recommendation.

Your Physician or Advanced Practice Provider will order the following medications for you to take prior to surgery.

1. **Mupirocin (Bactroban) nasal ointment**: Place a pea sized amount into both nostrils twice daily for 5 straight days. It will reduce your risk of different types of infections
while you are here in the hospital. It covers you for 3 months so you can start this medication at any time once you have received your surgery date.

2. **Chlorohexidine Body Wipes:** These wipes are to be used after your shower the day before surgery and again the morning of surgery to clean your skin.

3. **Amiodarone:** You will receive three (3) tablets. Take one at breakfast, lunch and dinner the day before your surgery only. This medication will reduce the chance of an irregular heart rhythm known as Atrial Fibrillation. This irregular rhythm occurs in about 40% of the cardiac surgery patients. Please do not be alarmed regarding the list of side effects that can occur with this medication. You are only taking three doses.

4. **Statin:** If you are not already on this cholesterol lowering medication, one pill will be ordered for you to take the night before surgery.

5. **Beta Blocker:** If you are not on a beta blocker, which is a type of medication that helps relax the heart, such as Lopressor (Metoprolol) or Coreg (Carvedilol), one dose will be ordered for you to take the evening before your surgery. If you are already on this medication, please take your routine dose the morning of surgery with a very small sip of water.

There are groups of blood pressure lowering medications called ace inhibitors (ACE), angiotensin receptor antagonist (ARBS) that will need to be held at least 36 hours prior to your surgery date. Any non-steroidal anti-inflammatory (NSAIDS) such as Advil can increase the risk of bleeding as well as post-operative kidney problems and these also need to be stopped at least 36 hours prior to surgery.

**Following are a list of some of these medications:**

1. Vasotec (Enalapril)  
2. Altace (Ramipril)  
3. Accupril  
4. Lisinopril  
5. Losartan  
6. Diovan  
7. Benicar  
8. Celebrex  
9. Avapro  
10. Advil  
11. Motrin

**If you have any questions regarding any of the above, please contact the Cardiothoracic Clinical Care Coordinators:**

- Jen Gopez, APN (908) 239-5492
- Lina Shi, APN (732) 354-2848
- Christine Savarese, APN (732) 673-7746
Same Day Surgery Admissions and Instructions:

- Do not eat or drink after midnight the night before your surgery

- You must use the skin prepping cloths (Chlorohexidine) given to you at pre-admission testing or at your office visit. Follow the instructions which were given to you at that time. Use the cloths the evening before and the morning of your surgery.

- Remove all nail polish/artificial nails

- If you have not moved your bowels in the 24 hours before the day of surgery, we request that you contact your physician for instructions about the proper laxative to take. You may take medications such as Metamucil or any fiber laxative that will enhance a bowel movement.

- If you were instructed to take your medications the morning of surgery, take them with a very small sip of water.

- On the morning of your admission, bring a list of your current medications and a list of those medications you have taken that morning.

- Do not bring valuables to the hospital such as jewelry or money. Rings must be removed before surgery. It is best to just leave them at home. Personal items can be brought to the hospital once you are transferred out of the Open Heart Recovery Room or Surgical Intensive Care Unit.

- Bring a copy of your Advanced Directive (Living Will) and/or Durable Medical Power of Attorney for health care. These documents allow us to follow your healthcare wishes and decisions in case you are unable to tell us yourself. Forms are available through the pastoral care division at (732) 937-8504.

- You will receive a phone call from our admissions department the evening prior to your scheduled surgery. They will inform you of the time you need to arrive at the hospital. Parking is available in the hospital deck or at valet parking. Please make every effort to arrive at the hospital on time. Nearby hotel accommodations are available at discounted rates. Call the hotel you are interested in staying in and inform them you are a patient at Robert Wood Johnson University Hospital.
During your operation, your family and friends should sign in at the surgical waiting area located on the main floor. Your family may be provided with updated information regarding the progress of your surgery.

Delays can happen and if a lengthy delay occurs, your family and friends will be notified. When the surgery is almost completed, someone from the operating room will call or come to the family waiting area to provide your family or friends with an update. When you are ready for visitors, a call will be placed into the waiting room and your family/friends will be escorted to your bed.
Your Heart
and
How it Works
The Heart

The heart is a muscle that is located near the center of the chest in a space called the thoracic cavity. An adult heart is about the size of an adult person’s fist. It beats, on average, 60-80 times a minute in order to pump blood throughout the body.

Chambers of the Heart:

The heart is divided into a left and right side.

The right side of the heart receives blood from the body and pumps it into the lungs where the blood can be filled with oxygen. The left side of the heart receives the oxygenated blood and then pumps it to the rest of the body.

The heart is divided on each side. These areas of the heart are called chambers, known as either an atrium or ventricle. There are two atria and two ventricles, one on each side.

Circulation:

The right atrium receives blood from blood vessels called the inferior (lower) vena cava and superior (upper) vena cava which then flows to the right ventricle which pumps the blood to the lungs. The left atrium receives the blood from a blood vessel called the pulmonary vein. The blood (which is now rich in oxygen from the lungs) flows into the left ventricle. The left ventricle pumps the blood out to the entire body through a blood vessel called the aorta.
Heart Valves:

Valves separate each chamber of the heart. These valves open to allow blood to flow from one chamber or blood vessel to enter another.

There are four valves within the heart:

- Mitral Valve
- Aortic Valve
- Tricuspid Valve
- Pulmonic Valve

The valves will be discussed later on in the manual.

Coronary arteries:

The heart is a muscle and therefore needs blood supply, too! The coronary arteries are the blood vessels on the heart muscle that power it.

The right coronary artery (RCA) feeds the right side of the heart.

The left main coronary artery (LMCA) starts on the left part of the heart and branches into the left anterior descending artery (LAD) and the circumflex artery (Cx). These branches feed the left side of the heart.
Aorta:

The Aorta is the largest blood vessel in the entire body. It transports oxygenated blood from the left ventricle to the entire body.

Parts of the Aorta:

1. The aorta starts with the aortic valve
2. The right and left coronary arteries, the blood vessels that feed the heart, branch off of the aorta
3. The next part is called the ascending aorta
4. The blood vessels that feed the brain and your arms come from the aortic arch
5. Next, the aorta moves downward and is then called the descending aorta
Coronary Artery Disease
Coronary Artery Disease (CAD)

Coronary artery disease develops when the major blood vessels that supply your heart with blood, oxygen and nutrients begins to have plaque buildup inside the arteries. This plaque also causes inflammation in your arteries and is usually to blame for coronary artery disease. The buildup of plaques occurs over many years. This build up in the arteries is called atherosclerosis.

Angina is chest pain or chest discomfort. These symptoms can occur in many different places, most commonly the chest, neck and jaw. It may feel like pressure, tightness, heaviness, burning or squeezing on the chest. Angina sometimes feels like indigestion.

If your coronary arteries narrow, they can't supply enough oxygen-rich blood to your heart — especially when it's beating hard, such as during exercise. At first, the decreased blood flow may not cause any symptoms. A partially blocked or completely blocked coronary artery may cause a heart attack. The classic signs and symptoms of a heart attack include crushing pressure in your chest and pain in your shoulder or arm, sometimes with shortness of breath, sweating and nausea.

Risk factors of Coronary Artery Disease:

1- **Family history.** A family history of heart disease is associated with a higher risk of coronary artery disease, especially if a close relative developed heart disease at an early age.

2- **Smoking.** People who smoke have a significantly higher risk of heart disease. Exposing others to your secondhand smoke also increases their risk of coronary artery disease.

3- **Age.** Simply getting older increases your risk of damaged and narrowed arteries.

4- **Sex.** Men are generally at greater risk of coronary artery disease. However, the risk for women increases after menopause.
5- **High blood pressure.** Uncontrolled high blood pressure can result in hardening and thickening of your arteries, narrowing the channel through which blood can flow.

6- **Unhealthy blood cholesterol levels:** High cholesterol can be caused by a high level of low-density lipoprotein (LDL), known as the "bad" cholesterol. A low level of high-density lipoprotein (HDL), known as the "good" cholesterol, can be a sign of atherosclerosis.

7- **Insulin resistance / DM** Diabetes is associated with an increased risk of coronary artery disease. Type 2 diabetes and coronary artery disease share similar risk factors, such as obesity and high blood pressure.

8- **Overweight or obesity.** Excess weight typically worsens other risk factors.

9- **Lack of physical activity:** Inactivity can increase your risk of developing CAD

10- **High stress.** Unrelieved stress can increase you blood pressure which may damage your arteries

11- **Metabolic syndrome:** Having at least three of the five following medical conditions: abdominal (central) obesity, elevated blood pressure, high triglycerides, and low high-density lipoprotein (HDL) levels.

Other possible risk factors, includes:

- **Sleep apnea.** This disorder causes you to stop and start breathing many times while you're sleeping. Sudden drops in blood oxygen levels that occur during sleep apnea increase blood pressure and strain the heart, possibly leading to coronary artery disease.

- **High sensitivity C-reactive protein.** High sensitivity C-reactive protein (hs-CRP) is a normal protein that appears in higher amounts when there's inflammation somewhere in your body.

- **High triglycerides.** This is a type of fat (lipid) in your blood. High levels may raise the risk of coronary artery disease, especially for women.

- **Pre-eclampsia:** This is high blood pressure during pregnancy, can be linked to an increase lifetime risk of heart disease including heart attack, heart failure and high blood pressure and coronary artery disease.
Coronary Artery Bypass Graft (CABG)
Coronary artery bypass grafting (CABG) is the most common open heart surgery. If you have been diagnosed with coronary artery disease (CAD) or clogged heart arteries, this surgery will improve blood flow to your heart. There are many arteries supplying blood to your heart. Your surgeon sees which of these arteries are not able to supply good blood flow to the heart muscle by looking at the pictures from your cardiac catheterization. This will determine the number of areas that need to be treated. It is possible to need a single bypass (1 diseased artery), double bypass (2), triple bypass (3) or a quadruple (4) bypass.

A CABG treats the clogged arteries by bypassing the blocked portion of the coronary artery with a healthy blood vessel from somewhere else in the body. This provides a clean route for blood to flow so the heart muscle can get enough oxygen filled blood.
Where are these pieces of healthy blood vessels from?

Veins

In both of your legs is a vein called the **Greater Saphenous Vein**. This vein runs from your ankle all the way to your groin. This vein, like all veins, carries blood back up to your heart. This is the blood vessel that is taken to use as a new, clean pathway for your bypasses. Your body will adjust to the removal of this vein but for some time you may have some swelling in the leg(s) from which the vein was taken.

In the past, one long incision was made to remove this vein. Today, the vein is taken through a small incision with the assistance of a camera. This procedure usually only requires a small incision to be made on the leg. At times, larger incisions or multiple incisions still may be necessary.

Before your surgery vein mapping (an ultrasound) will be performed on your leg to take a look at your saphenous vein. This gives the surgical team an idea of the size and health of your vein. A blue line will be drawn on your leg showing the location of this vein.

Arteries
The most common artery used for CABG surgery is the left Internal Mammary artery. This artery runs along both the left side and right side of your breast bone. As long as it is a healthy artery, this vessel will almost always be used for your surgery. The surgeon will remove this artery after the breastbone is opened so you will not have any additional incisions. Unless you have had a problem with blood flow with this area in the past, there are no tests needed to check this artery before surgery.

The radial artery is an artery in your forearm and can also be used for this surgery. If your surgeon plans to use the radial artery, tests will be done to make sure that your hand will stay healthy without this artery.

**HOW DO YOU GET THE NEW VESSELS ONTO MY HEART?**

To perform a **CABG** procedure the most common approach is to make an incision in the chest. The breast bone (sternum) is then divided exposing the heart. The heart is stopped to keep it still for the time it takes to perform the bypasses.

**MY HEART IS STOPPED?**

*The Heart Lung Machine- Cardiopulmonary Bypass*
To stop the heart without harming you during any heart surgery **Cardiopulmonary Bypass** is used. This means a machine is used to do the work of your heart and lungs.

Your surgeon puts two to three large tubes in your heart so blood can come out of your body, travel into the machine, get oxygen and then travel back into your body to supply it with oxygen just as if your heart was beating. Your heart is kept still with various medication and ice. When the surgery is finished, your heart is warmed up, allowed to beat again, and the tubes for bypass machine are taken out.

Sometimes a CABG surgery can also be performed on a beating heart or “**off bypass**”. Special tools are used to keep areas of the heart still so the vessels can be sewn safely. Different factors such as age, health of the heart and aorta, location of your clogged arteries; will determine if this is the best option for you.

**HOW IS MY CHEST CLOSED?**

When the surgery is done and your heart is beating well your breast bone will be brought back together with steel wires. These will stay in your chest forever, even after your sternum has healed. Your skin will be sewn together with sutures that will dissolve over time. You will not need to have these sutures removed. You will get instructions after your surgery on how to protect your healing breastbone and new incision.

**Chest Tubes after coronary artery bypass surgery**
After coronary artery bypass surgery tubes are usually inserted to remove excess fluid and or blood that can build up around the heart. These tubes are usually removed within 48 hours after surgery unless otherwise indicated. There are typically two to four tubes inserted.

After the chest tubes are removed another chest x-ray is performed to ensure no air has entered the chest cavity during removal. If significant air enters the chest cavity a new chest tube may need to be placed and kept in place for several days. This is the most common complication associated with removing a chest tube.

Aortic Valve
AORTIC VALVE DISEASE:

Aortic Valve disease is a condition in which the valve that is between your heart (your left ventricle) and the rest of your body (your aorta) does not work properly. Valves need to OPEN and CLOSE to allow the blood to flow to the rest of your body.

Aortic Valve Stenosis:
Aortic stenosis (AS) is one of the most common valve disease problems. Aortic stenosis is a narrowing of the aortic valve opening causing flow to be limited to the rest of the body. Since your heart has to work harder to pump blood through a narrow valve, the muscles in heart thicken which can lead to heart failure. Early treatment can help to reverse or slow down the progress of this disease.

**What causes it?**

Some people have AS as a result of a congenital heart defect known as bicuspid aortic valve, however, more commonly it develops during AGING as calcium or scarring damages the valve. This degenerative change results in limited valve leaflet motion.

Aortic stenosis is a quickly progressive disease. To date there is no medical treatment for severe aortic stenosis, which means there is only one option- SURGERY.

**Symptoms may include:**

- Shortness of breath
- Chest pain, pressure or tightness
- Fainting, also called syncope
- Palpitations or a feeling of pounding heartbeats
- Decline in activity level
Aortic Valve Regurgitation:

This is a condition where your Aortic valve doesn’t close completely and some of the blood that was pumped out of the heart leaks back in. As a result, your heart has to work harder because of the extra blood coming back in. This may lead to symptoms of heart failure.

What caused it?

The most common causes of severe aortic regurgitation is the weakening of the valve tissue due to aging, other causes are from high blood pressure, infection of the heart valve, congenital bicuspid aortic valve or an ascending aortic aneurysm which stretched the valve.

The severity of aortic regurgitation can sometimes be reduced with medications but surgical repairs are required in severe cases.

Symptoms include

- Irregular heart beat
- Palpitations
- Chest pain
- Fainting
- Shortness of breath

Surgical Options:

Repair vs. Replacement?

When it comes to the Aortic Valve it almost ALWAYS needs to be replaced.

There are two different types of valves used for replacement, Metal (mechanical) and tissue (bio prosthetic). These two options are discussed further in Chapter 8.

Surgical approach:
Aortic valve replacement requires the use of cardiopulmonary bypass, a machine that does the work of the heart and lungs and allows the surgeon to operate on the heart. The heart is stopped (while the machine does the work of the heart) and the operation involves opening the aorta (the large blood vessel on the top of your heart), removing the diseased aortic valve and then sewing in a new. The aorta is then closed and the heart is restarted. There are different approaches to performing this surgery.

***It is very important to remember that even though there are three different options of surgical approach, they may not be the best option for you. Your surgeon will talk to you about the different options and advise you as to which one is the best for you.***

**Minimally invasive approach:**

When it comes to “Minimally Invasive” approaches there are two…

- **Right Mini Thoracotomy approach:** A 3 inch incision is made horizontally approximately between the clavicle and the nipple, just to the right of the breast bone.

- **Mini Sternotomy approach:** An approximate 4 inch incision is made through the upper half of the breastbone.

**Groin Cannulation:** It is important to note that minimally invasive surgery requires a small incision on your groin to place the patient on heart lung machine. This allows the heart to rest and gives the surgeon access to the heart to perform the necessary operation.

Advantages of Minimally Invasive Heart Surgery are

- Shorter recovery period and often faster discharge from the hospital
- Fewer restrictions including driving
- Lower risk of wound infections
- Less pain
- Improved cosmetic outcome

**Sternotomy - Traditional approach:**

This is the most common surgical approach where the breastbone is divided into two allowing direct access to the heart.

Chapter 8 will provide a review of the types of valves available as well as the criteria involved when choosing the most appropriate valve for you.
Mitral Valve Disease
Mitral Valve Disease:

What is the problem?

The Mitral Valve, also known as the bicuspid or left atrioventricular valve, has two leaflets and sits between the left atrium and the left ventricle. The mitral valve allows blood to flow from the left atrium to the left ventricle.

Mitral valve insufficiency or regurgitation (“leaky valve”) is when the two mitral valve leaflets do not close together all the way.

Mitral Valve regurgitation can be an abnormality of the valve, artery disease or by enlargement heart (cardiomyopathy).

Mitral valve regurgitation damages the heart due to an increase in fluid causing the heart to work harder. The heart fails and the patient has heart failure. They have a weak heart that can’t pump the extra fluid causing back flow of blood into making it hard to breath. This type of valve disease requires surgical intervention.

Mitral valve stenosis (“tight valve”) is caused by Rheumatic heart disease, radiation, congenital (birth defect) causes, vegetation’s (cluster of infection) or calcium builds up around the valve.
In Mitral valve stenosis the pressures in the heart get higher due to the narrowing of the valve. The heart has to work harder to push the blood across a smaller opening. Patients will become more short of breath which can progress to shortness of breath at rest, dizziness and light headedness. As the heart works harder the muscle of the heart begins to thicken. The changes in the shape of the heart put the patient at risk for a blood clot in the atrium and irregular heart rhythm (atrial fibrillation).

There are several options for surgical repair of the mitral valve. These include a repair or a full mitral valve replacement. Most Mitral regurgitation is repairable using different strategies. Your surgeon will review these options with you and decide which one is best.

**Mitral Valve Annuloplasty (Ring):**

![Image of Mitral Valve Annuloplasty (Ring)](image-url)
Mitral valve Replacement:

Sometimes the Mitral valve disease is bad that the surgeon will replace your entire valve. The old valve is completely removed and a new valve is sewn in. There are two different types of valves used for replacement, Metal (mechanical) and tissue (bio prosthetic). These two options are discussed further in Chapter 8.

Surgical approaches:

Sternotomy is when there is a vertical (up and down) incision made along the breastbone (sternum) and the sternum is then divided into two parts.

Minimally invasive approaches for Mitral Valve Surgery have been developed so your surgeon can access the valve through a much smaller incision without cutting the breast bone.

An incision is made between the ribs on the right side of the chest. The ribs are spread, but no bone is cut. You are still required to go on the heart lung machine, so an incision in the groin is made.

Advantages of Minimally Invasive Heart Surgery are:

- Shorter recovery period and often faster discharge from the hospital
- Fewer restrictions including driving
- Lower risk of wound infections
- Less pain
- Improved cosmetic outcome
**Robotically assisted mitral valve surgery** is the use of a specially designed computer which allows your surgeon to control surgical instruments on thin robotic arms. A 1-2 cm incision is made to the right side of the chest. This approach provides a three dimensional view of the mitral valve and does not require the breast bone to be divided or for the ribs to be spread.

![Image of chest and heart]

**Groin Cannulation:** It is important to note that when you have minimally invasive surgery it requires a small incision in your groin to place the patient on the heart lung machine. This allows the heart to rest and gives the surgeon access to the heart to perform the necessary operation.

Benefits to minimally invasive versus standard open-chest cardiac operations are:

- Less pain
- Fewer complications
- Shorter hospital stay
- Shorter recovery time

***It is very important to remember that even though there are three different options of surgical approach, they may not be the best option for you. Your surgeon will talk to you about the different options and advise you as to which one is the best for you.***

Chapter 8 will provide a review of the types of valves available as well as the criteria involved when choosing the most appropriate valve for you.
Types of Heart Valves
Heart Valve Replacement Options

Tissue (Bio Prosthetic) vs. Mechanical

Sometimes a natural heart valve that is not working properly needs to be surgically replaced with a prosthetic valve. A prosthetic valve can be either mechanical or bio prosthetic (tissue). It is designed to mimic the natural valve’s normal opening and closing motions.

There are two types of valves available for replacement, metal (mechanical) or tissue (bio prosthetic) valve.

**Mechanical**

Metal (mechanical) valves are made of medical grade metals like Pyrolite carbon, a metallic substance that is very hard and durable. Due to its composition, the patient is required to take long term anticoagulation with Coumadin.

**Pros:**

- Very durable. Should last the natural lifespan of the patient and likely obviate the need for a replacement in the future barring any unforeseen mechanical failures.

**Cons:**

- Needs Coumadin anticoagulation.
  - Coumadin has a 1% risk per year of major bleeding event (most problematic is brain bleed).
  - Coumadin levels in the blood vary greatly day to day. As a consequence there will be a need for relatively frequent blood testing for the duration of Coumadin therapy.
  - There are foods that interfere with the action of Coumadin, namely leafy green vegetables. If Coumadin levels fall too low, the valve can clot leading to major complications, even death.
Due to its metallic nature, the valve makes a clicking noise with every heart beat that the patient may hear and in a quiet room, others may hear. Much like noises in the environment, however, the patient and others will get used to the sound and stop hearing it after a while.

There may be times that you are laying or sitting down in a quiet area and you hear a “clicking” sound. This is normal, it is the mechanical leaflets opening and closing properly. Do not be alarmed.

If a clot forms it can lodge in the valve flaps or hinges and cause a malfunction of the valve. Clots can also break off and move through the blood vessels to another blood vessel causing an obstruction. This obstruction can cause a complication like a heart attack or stroke.

**Bio Prosthetic (Tissue)**

Generally, the natural valves or bio prosthetic valves consist of either a pig valve (literally a valve that comes from a pig) or made from part of a cow heart (the sack around the cow heart-pericardium). They function and behave similarly.

**Pros:**

- They make no noise (quiet valves)
- No medicines needed specific to the valve. In general there is no need for Coumadin unless required for other reasons.
- Because these are not made from living tissues, there is no rejection or allergy to these valves. They are considered inert or non-reactive.

**Cons:**

- Because of the natural nature of these valves, they do wear out in time. Generally speaking they last on average 15 years. When they deteriorate, if the patient is alive and well, an intervention will be required.
Either valve functions equally well. The decision as to which type of valve, mechanical or bio prosthetic, is usually the patient's as these are lifestyle decisions. In general, however, patients over the age of 65 receive bio prosthetic valves to obviate the need for Coumadin anticoagulation as the patient gets older.
Diseases of the Aorta
Ascending Aortic Aneurysm:

The aorta is a large vessel that connects to the heart. Blood is pushed out of the heart and into the aorta which delivers the oxygenated blood to the rest of the body. The wall of the aorta expands and contracts each time the heart beats. This can create weakening of the aortic wall and loss of elasticity, enlargement (dilation) can occur. The aorta is broken down into three sections:

- **Ascending Aorta** – Part of the aorta that starts at the aortic valve and extends to the “arch”. The arch is the curved portion of the aorta where the blood vessels that supply blood to the brain and arms

- **Aortic Arch** – The part of the aorta that bends between the ascending and descending aorta. It leaves the heart and ascends, then descends back to create the arch.

- **Descending Aorta** – Portion of the aorta that starts to go down to the toes and extends down into the belly past the belly button.

**Risk Factors:**

- Uncontrolled Blood Pressure (#1 cause)
- Family history
- Marfan’s Syndrome,
- High Cholesterol
- Coronary Artery Disease
- Bicuspid Aortic Valve
- Infections
- Ehlers Danlos
- Smoking
- Peripheral vascular disease.

Blood pressure control is important in preventing the aneurysm from getting bigger. If the aneurysm grows too quickly there is a higher risk of the vessel tearing or rupturing.

**Signs & Symptoms:**

- Upper back pain
- Shortness of breath
- Chest pain
- Back pain
- Rapid heart rate
- Tearing pain

*Sometimes there are no symptoms and this disease of the aorta are found incidentally*
Aortic Dissection:

An Aortic dissection is when there is a tear in the wall of the aorta and blood flow begins to collect between the different layers of the aorta. A dissection separates the inner layer and the middle layer of the aorta, where blood collects. This can happen anywhere along the aorta.

Signs & Symptoms:

- Chest pain that can move around the chest
- Tearing/ripping sensations in the upper back usually between the shoulder blades
- Numbness or weakness of the legs

**If dissection is involving the ascending aorta, this is usually a surgical emergency**

There are two types of aortic dissections:

Type A Aortic Dissection: Tear anywhere on the ascending aorta, it can start from the aortic valve and can extend as far down as the belly. The only part that will be surgically repaired will be the ascending aorta.
**Type B Aortic Dissection:** Tear that starts in the descending aorta and can extend as far down as the belly.

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**Ascending Aortic Aneurysm or Dissection Repair:**
Portion of the damaged aorta is cut out and replaced with a Dacron/Gore-Tex graft (man-made polyester material). This operation is performed through a traditional sternotomy incision in the middle of the chest.
**Bentall Procedure:** Damaged portion of the aorta is replaced, the coronary arteries are sewn to the graft and the aortic valve is replaced.

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**Diastolic heart failure**

- Aorta
- Right ventricle
- Thick and stiff heart muscle

**Systolic heart failure**

- Left ventricle
- Thin and weak heart muscle

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**Hypothermic Circulatory Arrest:**

During typical open-heart surgery, blood continues to circulate throughout the body although major blood vessels are clamped to prevent the flow of blood into the surgical area. In aortic surgery, it is necessary to perform procedures without clamping the aorta while keeping the surgical field free of blood. An effective solution to the dilemma of how to temporarily stop blood circulation without causing injury to the patient resulted in the development of a technique in the 1970s known as hypothermic circulatory arrest (HCA). HCA is when the patient is cooled and placed in a state of suspended animation. This technique has proven to be so important to the long-term results in surgery of the ascending aorta that it is now the standard of care for this surgery. The ability to safely perform this procedure is due to the use of HCA during the time the aorta is open and unclamped.

HCA often slows the patient’s “waking”. This is not cause for alarm; the team will be monitoring the patient’s neurologic state constantly. We often allow the patient at least 24-48 hours to wake before performing any type of testing.
Ventricular Assist Device (VAD)
Heart failure:

Heart failure is a condition that occurs when the heart cannot pump or fill with enough blood, and is unable to pump enough blood through to meet the body's needs for blood and oxygen. Basically, the heart can't keep up with its demand.

The term "heart failure" is misleading because the heart does not completely fail or stop.

Heart failure can involve the heart's left side, right side or both sides.

Two types of heart failure:
- **chronic**, meaning it happens slowly over time
- **acute**, meaning it happens suddenly.

Heart failure can be mild and cause minor symptoms, or it may be severe or even life-threatening.

**Signs & Symptoms:**
- shortness of breath
- increasingly feeling tired
- leg swelling or stomach swelling
- everyday activities such as walking, climbing stairs or carrying groceries can become very difficult.

**Left-sided heart failure**

The heart's pumping action moves oxygen-rich blood as it travels from the lungs to the left atrium, then on to the left ventricle, which pumps it to the rest of the body. The left ventricle
supplies most of the heart's pumping power, so it's larger than the other chambers and necessary for normal function. In left-sided or left ventricular (LV) heart failure, the left side of the heart must work harder to pump the same amount of blood.

There are two types of left-sided heart failure - either the ventricle can’t pump, or it can’t relax.

**Systolic failure:**
The left ventricle cannot contract normally. It is too weak. The heart can't pump with enough force to push enough blood to the rest of the body.

**Diastolic failure:**
The left ventricle loses its ability to relax normally (because the muscle has become stiff). The heart can't properly fill with blood during the resting period between each beat.

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**Right-sided heart failure**

The heart's pumping action moves "used" blood that returns to the heart through the veins through the right atrium into the right ventricle. The right ventricle then pumps the blood back out of the heart into the lungs to be replenished with oxygen.

Right-sided or right ventricular (RV) heart failure usually occurs as a result of left-sided failure. When the left ventricle fails, increased fluid pressure backs up through the lungs, eventually damaging the right side of the heart. When the right side loses pumping power, blood backs up in the body's veins. This usually causes swelling or congestion in the legs, ankles and swelling within the abdomen.
Causes of heart failure:

- coronary artery disease
- valvular heart disease
- hypertension
- diabetes mellitus
- abnormal heart rhythms
- substance abuse

Treatments for heart failure

Heart failure can cause symptoms and make you feel ill. It can cause dangerous, even life-threatening complications. Left untreated, heart failure generally is a progressive condition. The goal of treatments for heart failure is to reduce symptoms, reduce the chance of developing complications and slow or stop the progression of the underlying process.

- **Medications:**
  - Medicines are often used to treat heart failure symptoms; some medicines have even been proven to prolong life.
- **Diet and lifestyle management:**
  - These changes include limiting salt and water intake, weighing yourself daily, controlling weight, stopping smoking, limiting alcohol, as well as exercising possibly in a cardiac rehab program
- **Heart rhythm treatment:**
  - Medications are sometimes used.
  - A pacemaker may be used to help coordinate the electrical signals between the ventricles allowing them to pump together. This is called cardiac resynchronization therapy, or CRT.
  - An implantable cardioverter-defibrillator or ICD may be used to shock the heart to stop a deadly arrhythmia (abnormal heart rhythm). It does not, however improve heart function or relieve symptoms of heart failure.
- **Surgery or stenting:**
  - This may be recommended if the circulation to your heart is poor, or if you have severe disease of a heart valve.

During the early phases, it is possible that the heart failure symptoms can be controlled with non-surgical interventions. It is very important to stay compliant with the prescribed plan of care in order to stay as healthy as possible.
Advanced heart failure:

Of the 5.7 million Americans living with heart failure, about 10% of those have advanced heart failure. The condition is considered advanced when conventional heart therapies and symptom management strategies no longer work. You feel shortness of breath and other symptoms even at rest.

Advanced heart failure cannot be cured, but it can be treated. Treatments can reduce your symptoms and help your heart pump as best it can. In fact, there is a growing selection of therapies and state-of-the-art technologies for helping to treat advanced heart failure.

Treatment options for advanced heart failure:

In addition to the heart failure treatment options discussed above, in advanced heart failure, other treatments may be considered.

- **Intravenous Medications (positive inotropes):**
  - These medications are used to make the heart beat more forcefully. You will need a more permanent intravenous access (PICC line) so you can receive these medications at home

- **Mechanical Circulatory Support (Ventricular Assist Device/VAD):**
  - These machines can help temporarily or as a more permanent treatment option. There are different types of these devices and each is chosen based on the patient’s particular situation.
  - Temporary devices may be used to help a patient recover from a reversible condition, such as sudden kidney failure, a heart attack, severe inflammation of the heart muscle (myocarditis) or shock. Quick action may be needed to temporarily support a failing heart until it has time to recover. These treatments can, however, be needed permanently if a patient’s health worsens. These temporary devices can be used until a more permanent therapy, such as placement of an implantable (long term) VAD or heart transplant can be done.
    - Temporary Devices:
      - AB 5000
      - CentriMag
      - Impella
  - Long-term implantable left ventricular assist device or LVAD, may be used as a “bridge to transplant” for patients awaiting a heart donor. When heart transplantation is not an option, an LVAD can help the heart pump blood for the
rest of a patient’s life. The pump is implanted in the upper part of the abdomen and functions as a mechanical heart, pulling blood from the left ventricle and sending it to the aorta for delivery to the rest of the body. A tube attaches the pump to a battery and control system worn outside the body. This permanent pump is either a HeartMate II or HeartWare. Your surgeon will discuss these options with you and advise you as to what is best.

ABIOMED AB5000:

The ABIOMED AB5000 Circulatory Support System is a mechanical support system that can provide left, right, or biventricular (left and right) support for patients whose heart have failed. The AB5000 Ventricle is external to (outside of) the patient and is intended for short-term use. Patients who might need the AB5000 system are often patients who have undergone successful cardiac surgery and subsequently their heart becomes weak (low cardiac output), or patients who suffer from a sudden cardiac event leading to hemodynamic instability.

Insertion of the AB5000 system is performed in the operating room through a midline incision along the breastbone (sternum).

In the event of recovery of cardiac function, removal of the AB5000 ventricles can be performed, but requires another surgical procedure. These patients will stay in the hospital until the device is removed.

THORATEC CENTRIMAG:

The CentriMag can be used for perioperative (after surgery) support of the failing heart. The CentriMag can be used to support the left or right side of the heart alone, or both sides of the
heart simultaneously. CentriMag can be used as a short-term solution to support the circulation while longer-term options are considered, and are therefore used as bridge to recovery, bridge to transplant, or as a temporary measure until a long-term implantable device can be placed. The device remains at the patient's bedside, and the tubing is usually inserted through a midline incision along the breastbone (sternum).

Patients with the CentriMag device must stay in the hospital but if well enough are able to get out of bed and even walk around the unit.

**IMPELLA**

Impella is ventricular assist device that acts like a temporary artificial heart; pumping blood throughout the body when the heart is too sick or weak to function. Patients with an Impella must remain in the hospital but are able to walk around the room and hallways.

**Types of Impella**
Impellas can provide support to the right ventricle of the heart and left ventricle of the heart individually or both can be inserted for biventricular support.

There are different sizes of left ventricular Impellas to choose from based on patient’s size and severity of illness.

**Impella 2.5:** Provides up to 2.5L/min of blood flow and can be inserted via a small hole in the femoral artery in the groin.

**Impella CP:** Provides up to 3.5L/min of blood flow and can also be inserted via a small hole in the femoral artery in the groin.

**Impella 5.0:** Provides up to 5.0L/min of blood flow and can be inserted via a small hole into the femoral artery in the groin, axillary artery near the collarbone or directly into the aorta.

The inlet of the **right ventricular Impella** sits in the inferior vena cava (large vein near the diaphragm) and the outlet sits in the pulmonary artery- delivering blood to the lungs for oxygenation.

**Impella RP:** Provides greater than 4L/min of blood flow and can be inserted via small hole in the femoral vein in the groin.

**Heart Mate II:**
The Heartmate II is a left ventricular assist device (LVAD) that helps the left ventricle pump blood to the rest of the body. It is an implantable pump with parts which are attached to the heart surgically inside the body and are then connected to the battery and controller which sit outside the body. Heartmate II is a pump that runs on electricity and needs to be plugged into an electrical outlet or connected to batteries at all times.

The Heartmate II is FDA approved for use in patients with end stage left ventricular failure who are not a candidate for heart transplant- also known as destination therapy, and for patients with end stage left ventricular failure who are candidates for heart transplant but are at risk for imminent death from heart failure- also known as a bridge-to-transplant. Currently there are no long term implantable devices for end stage right ventricular failure.

A Heartmate II device is inserted via an incision over the breastbone. The breastbone is then divided in two giving access to the heart. The Patient is placed on the bypass machine while the pump is sewn onto the heart. The thin flexible power cord is then tunneled under the skin and exits the body from abdomen and is connected to an outside controller.

The advanced heart failure team will be involved in the patient education portion. When able, the patient can go home and care for this device with support from family or friends.
Post- Operative Course and Potential Complications
POST OPERATIVE COURSE

After surgery an entire team of highly skilled Cardiac surgery Doctors, intensivists, advance practice providers and nurses and will be managing your care up to your discharge.

After completion of surgery you will be taken either to open heart recovery room (OHRR) or surgical intensive care unit (SICU). You will be comfortable and sleeping due to anesthesia and ample pain medication will be administered to ensure you are pain free. Your family will be able to visit about an hour after completing your surgery. There will many IV’s, wires, tubes and monitors connected for close monitoring.

Once you are awake and anesthesia has worn off, the breathing tube that is in place to help you breath will be removed. It is our goal to have you off of the breathing machine in less than four to six hours. Immediately after, deep breathing exercise will be important. The nurse and respiratory therapist will assist you. You will have a “breathing toy” called an incentive spirometer. It is very important for you to use this toy at least five times an hour after you are removed from the breathing machine.

Once you are stable to be transferred out of the OHRR/SICU, you will be brought to our step down unit called 2-Core. Typically, your chest tubes and temporary pacing wires, if present, will be removed by an Advanced Practice Provider on post op day 2 or 3. It is our priority to allow you to heal and at the same time having you out of the hospital in a timely manner.
Since blood sugar control after surgery is crucial for healing, all cardiac surgery patients are temporarily started on insulin which will be stopped within 48-72 hours after surgery. When discharged, you may remain on some insulin or pills to control your sugar.

The physical therapist will assist you with mobility and exercise. The physical therapy team is there to assess what your needs will be upon discharge. If it is determined that you will need to go to a rehab facility for a short time, a social worker will come and discuss placement options with you.

Deep breathing continues to be of utmost importance to avoid breathing complications such as pneumonia.

**Possible post-operative complications**

Some of the more common complications that can occur after surgery include bleeding, irregular heart rhythms like atrial fibrillation (AFib), pleural effusions, blood clots, infection, kidney injury and temporary memory loss.

**Bleeding:**
As with any kind of major surgery, there are risks. Complications of surgery are rare, but they are still a concern. Bleeding occurs most frequently and often resolves with a transfusion of blood and other types of blood products. Occasionally bleeding may be severe enough to require additional surgery.

**Heart rhythm problem:**
Atrial fibrillation or irregular heart beat is a common abnormal rhythm we encounter after surgery. Atrial fibrillation may be severe enough to impair the heart’s ability to pump blood properly and result in very low blood pressure. If this rhythm continues it may cause blood clots to form in the heart that can then go to the brain resulting in a stroke. Blood clots can travel to other organs in the body and impair blood flow. Other abnormal heart rhythms may occur but are less common. You will be monitored very closely by our skilled staff and treatment for these rhythms will be started as soon as possible.

**Pleural effusions:**
After surgery fluid can collect around the lungs making it difficult to breathe. Typically the body will absorb most of the fluid but at times intervention is required and a procedure called thoracentesis may be performed. The area on your back will be numbed, a needle is inserted and fluid will be drained. In the event there is a large amount of fluid, a small tube is inserted, once all the fluid is removed, the tube is also removed.

**Blood clots:**
In general, surgery increases the risk for the development of blood clots in the legs that can travel to the lungs resulting in a pulmonary embolism. To prevent this we ensure that patients are on the proper blood thinning medications when appropriate and are out of bed and walking as soon as it is deemed safe.

**Infection:**
There are many factors that increase the risk of developing an infection after surgery. Patients with poorly controlled diabetes have a higher risk for developing infections after surgery. Good blood sugar control after surgery is very important in decreasing the risk of infection after
surgery in diabetic patients. Although the risk of infection can’t be totally eliminated, care is taken by all staff members to reduce that risk.

**Kidney Failure:**
Although small, kidney failure is another risk in patients who undergo cardiac surgery. Here at RWJUH we have an excellent team of kidney specialists who assist us in treatment and management of patient should a kidney problem develop.

**Memory loss:**
Memory loss and difficulty thinking is sometimes reported in patients who undergo coronary bypass surgery. This problem typically resolves on its own. It is likely due to the medications used during surgery.

**Allergic reactions to Anesthesia:**
Having an allergic reaction to anesthesia is a risk for any patient who undergoes a procedure that requires general anesthesia. Allergic reactions can be mild resulting in hives or severe resulting in very low blood pressure and swelling. You will be monitored closely by our Anesthesiologists for these reactions.

**Death:**
Death is a risk when undergoing any major surgery. If you are being considered for surgery it is likely that the risks and benefits of surgery have been weighed by your cardiologist and cardiac surgeon and surgery was determined to be the best treatment option for your heart disease.

**Preparing for discharge:**
Based on your overall health and wellbeing you will be discharged either to rehab facility or home. This decision is made as a team including you and your family. If you are weak and not as mobile we strongly encourage rehab but if you are ambulating well and able to perform daily activities without difficulty then we encourage going home.
You will be given a list of medications to take on a daily basis. Frequently the medications after surgery are different than the ones you were taking before surgery so pay close attention to the list given before discharge. Nurses will go over detailed instructions and also provide you with detailed written instructions on how and when to take your medications.

You are strongly encouraged to ambulate regularly throughout the day including some stairs. You are also to continue deep breathing exercise at home to avoid complications like pneumonia. You are not to lift anything greater than 5lbs (size of a gallon of milk).
Outpatient Follow Up
GOING HOME AFTER YOUR OPEN HEART SURGERY

1. Follow Up Appointments:
Regardless of whether or not you are discharged to home or to a rehabilitation facility, you will need to call the Appointment Line at 732-235-7800 and choose option 2 to make the following 2 separate appointments:

1) With the cardiac surgery Nurse Practitioner in **1 week**. During this visit, your overall progress will be assessed; abnormal findings will be treated to prevent worsening of the condition and rehospitalization. All your questions will be answered, and any concerns you have will be addressed.
2) Follow up appointment with your cardiologist **2 weeks** after discharge. Please call your cardiologist as soon as you get home to make this appointment
3) With your Surgeon in **3 weeks**

2. Care for your surgical incision sites:
It is safe to wash your incision daily with soap and water.

You should shower daily using mild soap and warm water, pat your incisions dry. Avoid vigorous scrubbing. When closing your incision, the team uses “glue” called Dermabond to seal the incision. This will flake off in time, do not pull at the Dermabond; this could disrupt the healing process.

You will not be able to soak in a bath or submerge in water until your incisions are all completely healed and there are no visible scabs.

Do not apply any ointments or creams to your incisions. If you are concerned about your incision, just call!

Inspect your incision daily and call if any of the following occur:
- Increased tenderness of the incision line or drainage
- Increased redness or swelling around the edge of the incision

Some patients have 2-3 small holes below their chest incision. This is where the chest tubes were placed during surgery. You may have some drainage from these sites for the first few days after the chest tubes are removed, this is normal as these sites will heal from the inside out. You can cover them with a band aid or small gauze. They should become dry and scab over within a
few days. You should call the Cardiothoracic Surgery office if the area becomes red or if the drainage changes at all.

It is normal to have some swelling on the legs, especially if you have an incision in your leg. The leg with the incision will tend to swell more. Having your legs elevated to the level of your heart when sitting will help decrease swelling in your legs.

**Sternal precautions:**

It is important to hug a pillow to your chest incision when you cough. This will reduce pain and prevent any tension on your chest incision. This is especially true if you have had a sternotomy - this is when your breast bone (sternum) was cut during surgery and then closed with wires. Women with large breasts should wear a surgical bra or their own bra that does not have an underwire. Wear a bra to bed or when lying flat. This will prevent pulling and tension on your chest incision and promote healing. Using bras with front closure are easier to put on. You should avoid lifting, pushing, or pulling anything heavier than 10 pounds (about a gallon of milk) for 3 months until the sternum is completely healed.

**3. Ambulation and Activities:**

It is very important to keep active after open heart surgery. You should walk daily and perform all your normal daily activities such as dressing, showering, and eating meals at the table.

Benefits of being active include: improved strength of your muscles, decreased emotional stress, increased endurance, less fatigue, earlier return to pre-surgery activity level, decreased risk of clot formation in your legs, and decreased risk of collapse of the air-sacks in your lungs (atelectasis) or developing a lung infection (pneumonia).

Try to take 4 to 5 short walks every day and increase the distance gradually every 2-3 days. Walk at your own pace. Avoid vigorous exercises and do not walk faster than 3 miles per hour until approved by your doctor. If you feel your pulse rate steadily increasing during exercise, take a break and sit down.

You can climb stairs. Climb stairs slowly and at your own pace.
Keep in mind; in the beginning it is normal to feel tired easily and to have mild shortness of breath with activities.

4. **Food and Nutrition:**

Your body and your incisions need proper nutrition in order to heal.

It is normal to have little or no appetite right after the surgery. Foods may not taste good or have no taste at all after open heart surgery. It can take several weeks for your taste and appetite to improve.

Eat small frequent meals every 2-3 hours including high-protein foods, fruits, and vegetables.

Consider adding a supplemental protein drink in between meals, but be careful of the sodium content. Choose one that **does not have more than 500 mg of sodium per serving.**

5. **Pain and Numbness:**

It is normal to have mild to moderate pain at the incision sites or have muscle pain and tightness in your shoulders and upper back between your shoulder blades. Muscle discomfort will get better over time. The incisional pain is usually associated with activities or coughing. The pain should decrease with stopping of the activity. You should take pain medication when needed, as prescribed, so you can keep yourself active, take deep breaths, and cough effectively.

You may also have numbness near or around the chest and leg incisions, or in your arm or hand where any needles were inserted during surgery. The numbness is due to the manipulation of the nerves during surgery or insertion of a needle. It may take up to several months for the sensation to return back to normal.
5. Feelings and Emotions:
It is normal to have mood swings, and to feel sad, frustrated, angry, or depressed. There will be good days and bad days.

Remember: It takes time for emotional healing, but it WILL get better as you get physically stronger and become more active.

6. Respiratory Care:
Continue to use your Incentive Spirometer regularly (the hand-held device with a ball inside that is given to you after your operation): 10 repetitions 4 times per day for the first 1-2 weeks after discharge.

7. Sleep and Rest:
It is normal to have difficulty falling asleep or to awaken in the middle of the night and be unable to go back to sleep. This will improve over time. Taking a pain pill before bed may help.

Take frequent rest periods between activities. Take short naps as needed.

8. Sexual Activity:
You can resume sexual activity when you feel comfortable, usually 2-4 weeks after discharge.

Most doctors agree that you are able to resume sexual activity once you can climb two flights of stairs without feeling too tired or short of breath. However, for three months, you should avoid pressure on the sternum or chest wall and avoid using your arms to support your body weight.
9. Driving and Traveling:

You can ride in a car as a passenger at any time. You can ride either in the back or front seat. However, if sitting in the front, you should move the seat back as far as possible to avoid the airbag in the event of an accident. You may place a pillow between your chest and the seat belt to avoid irritation.

If you had a minimally invasive procedure with a small incision on the right side of your chest, you may resume driving after 2 weeks. If you have had a sternotomy with an incision in the center of your chest, you should avoid driving for 4 weeks to allow your breastbone to heal.

Do not travel by air for the first month after open heart surgery or until you discuss with your surgeon.

When traveling long distances, make sure that you walk around for a few minutes every 2 hours.

10. Returning to work:

Most patients can return to light work in 6-12 weeks. You can check with your surgeon before returning to work.

11. Medications:

Take all your medications as prescribed.

On discharge, your medications may be different than the medications you took before your open heart surgery. Take only the medications prescribed by your Cardiac Surgery team. If you have medications at home that are not on the list of medications when you are discharged, do not take them until you check with your Cardiac Surgery Nurse Practitioner.

**Bring your current medication list or your medication bottles to all of your nurse practitioner and doctor appointments.**
12. **Call 911 or go to nearest emergency room if you experience the following:**

- bright red stool
- chest pain similar to before surgery
- fever of greater than 101 degrees along with shaking chills
- coughing up bright red blood
- fainting spell
- extremely slow or fast pulse rate
- new irregular pulse rate
- new onset of nausea, vomiting, or diarrhea
- severe abdominal pain
- shortness of breath not relieved by rest
- sudden numbness or weakness in arm or leg
- sudden, severe headaches

13. **Call your medical doctor or your Cardiologist if you have:**

- acute gout flare-up
- extreme fatigue
- pain in calf of leg that becomes worse when pointing toe up to head
- new sharp pain when taking a deep breath
- skin rash
- symptoms of a urinary tract infection including frequent urination, burning with urination, urgency with urination, blood in the urine
- weight gain of more than 2 pounds within 24 hours two days in row or more than 5 pounds in one week
- increased ankle swelling
- increased shortness of breath

14. **Call your surgeon if you have:**

- persistent bleeding or large amount of oozing from incisions
- redness that spreads out more than one inch from incision edges
- increased warmth in the skin around incision
- yellow, green, or white drainage with odor
- increased pain or swelling around incision
- temperature greater than 100.5 F two times in 24 hours

You can leave message for non-urgent calls or for medication refills at 732-235-6556.