Minimally Invasive Heart Surgery

Minimally invasive heart surgery (also called keyhole surgery) is performed through small incisions, sometimes using specialized surgical instruments.

The incision used for minimally invasive heart surgery is about 3 to 4 inches instead of the 6- to 8-inch incision required for traditional surgery.

Robotically-Assisted Heart Surgery

Robotically-assisted heart surgery, also called closed-chest heart surgery, is a type of minimally invasive surgery. The cardiac surgeon uses a specially-designed computer console to control surgical instruments on thin robotic arms. Robotic-assisted technology allows surgeons to perform certain types of complex heart surgeries with smaller incisions and precise motion control, offering patients improved outcomes.

In robotic surgery, small incisions — less than 2 inches — are used, compared with the 3- to 4-inch incision used in traditional minimally invasive heart surgery.

Benefits of Minimally Invasive Surgical Techniques

The benefits of minimally invasive and robotic heart surgery techniques include:

- A smaller incision
- A smaller scar

Other possible benefits may include:

- Decreased risk of infection
- Less bleeding
- Less trauma, including less pain
- Decreased length of stay in hospital after surgery: the average stay is 2 to 5 days after minimally invasive surgery, while the average stay after traditional heart surgery is 7 to 10 days
- Decreased recovery time: the average recovery time after minimally invasive surgery is 1 to 4 weeks, while the average recovery time after traditional heart surgery is 6 to 8 weeks. The recovery time and return to regular activities is shorter for patients who undergo robotically-assisted heart surgery.
- Division of the breastbone or spreading of the ribs is usually not needed for robotically-assisted heart surgery.

Important Note: Not everyone is a candidate for these surgical techniques. Your surgeon will review the results of your diagnostic tests before your scheduled procedure to determine if you are a candidate for minimally invasive surgery. The surgical team will carefully compare the advantages and disadvantages of minimally invasive techniques versus traditional surgery techniques.
Minimally Invasive CABG Surgery

Minimally invasive direct coronary artery bypass graft (MID CABG) surgery is an option for some patients who require a left internal mammary artery bypass graft to the left anterior descending artery.

Saphenous (leg) vein harvest may also be performed using small incisions.

Several techniques for minimally invasive CABG surgery are being explored at Cleveland Clinic, including surgeries performed on a beating or non-beating heart.

Off-pump or beating heart bypass surgery allows surgeons to perform surgery on the heart while it is still beating. A medication may be given to slow the heart during surgery, but the heart keeps beating during the procedure. This type of surgery may be an option for patients with single-vessel disease (such as disease of the left anterior descending artery or right coronary artery).

Traditionally, CABG surgery is performed with the assistance of cardiopulmonary bypass (heart-lung machine). The heart-lung machine allows the heart’s beating to be stopped, so the surgeon can operate on a surface which is blood-free and still. The heart-lung machine maintains life despite the lack of a heartbeat, removing carbon dioxide from the blood and replacing it with oxygen before pumping it around the body.

During off-pump or beating heart surgery, the heart-lung machine is not used. The surgeon uses advanced operating equipment to stabilize (hold) portions of the heart and bypass the blocked artery in a highly controlled operative environment. Meanwhile, the rest of the heart keeps pumping and circulating blood to the body.
Types of Robotically-Assisted Heart Surgeries

Robotically-Assisted Valve Surgery

Robotically-assisted mitral valve repair can be used to treat mitral valve regurgitation. Tricuspid valve surgery also can be performed using the robotically-assisted surgical technique.

Robotically-Assisted Bypass Surgery

Robotically-assisted coronary artery bypass graft surgery can be performed without requiring the opening of the sternum (breastbone) or spreading of the ribs. Robotically-assisted CABG surgery also can be performed “off pump,” which means the surgery can be performed on a beating heart, without using the heart-lung machine.

Robotically-Assisted ASD and PFO Repair

Robotically-assisted atrial septal defect (ASD) and patent foramen ovale (PFO) repair surgeries can be performed using a robotically-assisted approach. Robotic instruments are used to harvest a small patch of pericardial tissue (the sac that surrounds the heart). The patch is then sutured over the defect.

Robotically-Assisted Removal of Cardiac Tumors

The most common benign tumor of the heart is a myxoma, which most frequently occurs in the left atrium. This type of tumor increases the risk of stroke. Removal of these tumors is almost always curative and greatly reduces the risk of stroke. During the robotically-assisted tumor removal procedure, the surgeon’s hands control the movement and placement of the endoscopic instruments through small incisions in the left atrium, and the instruments are used to remove the tumor.

Robotically-Assisted Heart Surgery

Robotically-assisted heart surgery is performed through three small incisions or “ports” that are made in the spaces between the ribs (image above left). The surgical instruments (attached to the robotic arms) and one camera are placed through these ports. Motion sensors are attached to the robotic “wrist” so the surgeon can control the movement and placement of the surgical instruments to perform the procedure.

With robotically-assisted surgery, the sternum (breastbone) usually does not need to be opened and the ribs do not need to be spread to perform the procedure, in most cases. Depending on the technique, the surgeon may choose to perform surgery on a “beating heart,” while the patient is not placed on the heart-lung bypass machine (this is called “off-pump” surgery).

In comparison, traditional valve and coronary artery bypass graft (CABG) surgery involve placing the patient on the heart-lung bypass machine to circulate oxygenated blood during surgery and stop the heart in order to stabilize the blood vessels; creating a 6- to 8-inch incision through the sternum; and spreading the ribs to view the heart.
Robotically-Assisted Device Implant for Heart Failure

During the robotically-assisted biventricular pacemaker or defibrillator implant procedure, the surgeon’s hands control the movement and placement of the endoscopic instruments through small incisions in the right atrium. This surgical technique can be used to place leads on the surface of the left ventricle. The leads are then attached to the biventricular device (defibrillator or pacemaker) to “resynchronize” the heartbeat and improve heart failure symptoms.

Robotically-Assisted Atrial Fibrillation Surgery

During the robotically-assisted catheter ablation procedure for atrial fibrillation, the surgeon’s hands control the movement and placement of the endoscopic instruments to open the pericardium (thin sac that surrounds the heart). The instruments are used to precisely place the catheter for ablation, in which energy is applied to correct the abnormal heart rhythm. Catheter ablation is used to treat certain forms of atrial fibrillation (an irregular heart rhythm arising from the upper chambers of the heart).

Who is a Candidate for Minimally Invasive or Robotic Surgery?

Your surgeon will review the results of your diagnostic tests before your scheduled surgery to determine if you are a candidate for a minimally invasive or robotic surgery technique. The surgical team will carefully compare the advantages and disadvantages of these techniques with those of traditional surgery.

The type of treatment recommended for your condition depends on several factors, including the type and severity of heart disease, your age, medical history and lifestyle.

How Will I Feel After Surgery?

You may feel some incision discomfort for the first few days after surgery. Medications can be taken to help relieve this discomfort. Ask your doctor which medication you should take for pain relief. If you begin to have discomfort in your chest that is similar to the symptoms you had before your surgery, call your doctor.

Recovery

Patients who had minimally invasive or robotic surgery may be able to go home 2 to 5 days after surgery. Your health care team will follow your progress and help you recover as quickly as possible.

Your health care team will provide specific instructions for your recovery and return to work, including guidelines for activity, driving, incision care and diet.

Recovery after minimally invasive heart surgery

In general, you may be able to return to work (if you have a sedentary job), resume driving and participate in most non-strenuous activities within 1 to 4 weeks after traditional minimally invasive heart surgery. You can resume heavy lifting and other more strenuous activities within 5 to 8 weeks after surgery. Your health care team will provide specific guidelines based on your rate of recovery.

Recovery after robotically-assisted heart surgery

The recovery time after robotically-assisted heart surgery is shorter than traditional minimally invasive heart surgery. Most patients can resume normal activities, drive and return to work as soon as they feel up to it — usually within a few days to one week after surgery. Your health care team will provide specific guidelines based on your rate of recovery.

Recovery for all patients after heart surgery

To maintain your cardiovascular health after surgery, making lifestyle changes and taking medications as prescribed are strongly recommended. Heart-healthy lifestyle changes that are important to your recovery include:

- Quitting smoking
- Treating high cholesterol
- Managing high blood pressure and diabetes
- Exercising regularly
- Maintaining a healthy weight
- Eating a heart-healthy diet
- Participating in a cardiac rehabilitation program, as recommended
- Following up with your doctor for regular visits
The Sydell and Arnold Miller Family Heart & Vascular Institute is one of the largest cardiovascular specialty groups in the world, providing patients with expert medical management and a full range of therapies. Our cardiac care program has been ranked number one since 1995 by *US News & World Report*.

Our areas of expertise combine research, education and clinical practice to provide innovative and scientifically-based treatments for cardiovascular disease. The commitment of our physicians and scientists to the prevention and cure of cardiovascular disease has led to innovative care, better outcomes and improved quality of life for patients with cardiovascular disease.

Cardiologists and surgeons in the Miller Family Heart & Vascular Institute specialize in the treatment of cardiovascular disease. Our team approach ensures that patients receive the best care before, during and after their procedure.

**For More Information**

To make an appointment, please call **216.444.6697 or 800.223.2273 ext. 46697**.

For more information, please contact the **Heart & Vascular Institute Resource Center Nurse toll-free at 866.289.6911** or e-mail us using the Contact Us form on the web at [www.clevelandclinic.org/heart](http://www.clevelandclinic.org/heart). We would be happy to answer your questions.