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Coronary artery bypass grafting CABG

- CABG was introduced in the 1960s
- aim of offering symptomatic relief, improved quality of life, and increased life expectancy to patients with CAD.
- By the 1970s, CABG was found to increase survival rates in patients with multivessel disease and left main disease when compared with medical therapy.
- Despite these initial positive results, the European Coronary Surgery Study conducted in the 1970s indicated that the significant improvement in 5-year survival rates
- CABG became a routine operation in patients with CAD.

- Coronary artery bypass grafting (CABG) is performed for patients with coronary artery disease (CAD) to improve quality of life and reduce cardiac-related mortality.

- **Indications**
- Left main coronary artery stenosis >50%
- Stenosis of proximal LAD and proximal circumflex >70%
- 3-vessel disease in asymptomatic patients or those with mild or stable angina
- 3-vessel disease with proximal LAD stenosis in patients with poor left ventricular (LV) function
- 1- or 2-vessel disease and a large area of viable myocardium in high-risk area in patients with stable angina
- >70% proximal LAD stenosis with either ejection fraction < 50% or demonstrable ischemia on noninvasive testing

- Other indications for CABG include the following:
- Disabling angina (Class I)
- Ongoing ischemia in the setting of a non–ST segment elevation MI that is unresponsive to medical therapy (Class I)
- Poor left ventricular function but with viable, nonfunctioning myocardium above the anatomic defect that can be revascularized
- CABG may be performed as an emergency procedure in the context of an ST-segment elevation MI (STEMI) in cases where it has not been possible to perform percutaneous coronary intervention (PCI) or where PCI has failed and there is persistent pain and ischemia threatening a significant area of myocardium despite medical therapy.

- **Contraindications**
- CABG is not considered appropriate in asymptomatic patients who are at a low risk of MI or death. Patients who will experience little benefit from coronary revascularization are also excluded.
- Although advanced age is not a contraindication, CABG is less commonly performed in the elderly. Because elderly patients have a shorter life expectancy, CABG may not necessarily prolong survival. These patients are also more likely to experience perioperative complications after CABG.

- **Preprocedural evaluation**
- Before CABG, the patient's medical history should be carefully examined for factors that might predispose to complications, such as the following:
- Recent MI
- Previous cardiac surgery or chest radiation
- Conditions predisposing to bleeding
- Renal dysfunction
- Cerebrovascular disease including carotid bruits and TIA
- Electrolyte disturbances that might predispose the patient to dysrhythmias
- Infection, including urinary tract infection and dental abscesses
- Respiratory function, including the presence of COPD or infection[3]

- Routine preoperative investigations include the following[3] :
- Full blood count (abnormalities corrected)
- Clotting screen
- Creatinine and electrolytes (abnormalities corrected and discussed with the anesthetist)
- Liver function tests
- Screening for methicillin-resistant *Staphylococcus aureus*
- Chest radiography
- ECG
- Echocardiography or ventriculography (to assess LV function)
- Coronary angiography (to define the extent and location of CAD)

- **Premedication**
- The aims of premedication are to minimize myocardial oxygen demands by reducing heart rate and systemic arterial pressure and to improve myocardial blood flow with vasodilators. Drugs that should be continued up to the time of surgery are as follows:
- Beta-blockers, calcium channel blockers, and nitrates
- Aspirin
- Agents given are as follows:
- Temazepam immediately preoperatively
- Midazolam, a small IV dose in the operating room before arterial line insertion
- Each patient should be cross-matched with 2 units of blood (for simple cases) or 6 units of blood, fresh frozen plasma, and platelets (for complex cases

- **Anesthesia**
- Cardiac surgery makes use of the following 2 forms of neuraxial blockade:
- Intrathecal opioid infusion
- Thoracic epidural anesthesia (generally a low-dose local anesthetic/opioid infusion)

- **Monitoring**
- In addition to the standard anesthetic monitoring (ECG, pulse oximetry, nasopharyngeal temperature, urine output, gas analysis), specific monitoring requirements for cardiac surgery include the following:
- Invasive blood pressure
- Central venous access
- Transesophageal echocardiography (TEE)
- Neurologic monitoring

- **Technique**
- Sites from which the conduit can be harvested include the following:
- Saphenous vein
- Radial artery
- Left internal thoracic (mammary) artery (LITA)
- Right internal thoracic (mammary) artery (RITA)
- Right gastroepiploic artery
- Inferior epigastric artery
- Splenic artery
- The usual incision for CABG is a midline sternotomy, although an anterior thoracotomy for bypass of the LAD or lateral thoracotomy for marginal vessels may be used when an off-pump procedure is being performed. Cardiopulmonary bypass, cardioplegic arrest, and placement of graft follows.

- Alternative approaches to CABG include the following:
- Off-pump CABG
- Totally endoscopic CABG
- Hybrid technique (bypass plus stenting

- Technical Considerations
- **Best practices**
- Either veins or arteries may be used as conduits for CABG. The great and small saphenous veins are the most commonly used vein grafts, and the internal thoracic (mammary) artery is the most commonly used artery.
- The disadvantage of saphenous vein grafts is their declining patency with time: 10-20% are occluded 1 year after surgery because of technical errors, thrombosis, and intimal hyperplasia.

- Another 1-2% of vein grafts occlude every year from 1-5 years after surgery, and 4-5% occlude every year from 6-10 years after surgery. Vein graft occlusion that occurs 1 or more years after CABG is due to vein graft atherosclerosis. At 10 years after surgery, only 50-60% of saphenous vein grafts are patent, and only half of these are free of angiographic atherosclerosis.

- Unlike saphenous vein grafts, internal thoracic artery grafts exhibit stable patency over time. At 10 years, more than 90% of internal thoracic artery grafts are patent. The left internal thoracic artery should be the conduit used when the left anterior coronary artery is bypassed.

- **Positioning**
- For a standard sternotomy, the anterior thorax is exposed with the patient in a supine position. A roll is placed in the interscapular region to improve access to the sternum by extending the neck and elevating the sternal notch.

- Monitoring and Follow-up
- In addition to the standard anesthetic monitoring (electrocardiography, pulse oximetry, nasopharyngeal temperature, urine output, and gas analysis), there are a number of specific monitoring requirements for cardiac surgery, including the following:
- Invasive blood pressure
- Central venous access
- Transesophageal echocardiography (TEE)
- Neurologic monitoring

- Complications
- A number of complications are associated with CABG, both in the short term and in the long term; they are associated with anesthesia, cardiopulmonary bypass,sternotomy, and the operation itself. These complications may include the following:
- Myocardial dysfunction
- Cerebrovascular complications
- Acute renal failure
- Cardiac tamponade
- Respiratory tract infections
- Aortic dissection

- **minimally invasive heart surgery**

- **Definition**
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- In minimally invasive heart surgery, heart (cardiac) surgeons perform heart surgery through small incisions in the right side of your chest, as an alternative to open heart surgery.

- Surgeons operate between the ribs and don't split the breastbone (sternotomy), which results in less pain and a quicker recovery for most people. In minimally invasive surgery, your heart surgeon has a better view of some parts of your heart than in open heart surgery. As in open surgery, minimally invasive heart surgery requires stopping your heart temporarily and diverting blood flow from your heart using a heart-lung machine.

- Surgeons perform many minimally invasive heart surgeries, including:
- Aortic valve surgery
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- Atrial septal defect closure, including patent foramen ovale
- Atrioventricular canal defect (also called atrioventricular septal defect) surgery
- Heart valve surgery to treat heart valve disease
- Maze heart surgery to treat atrial fibrillation
- Mitral valve surgery
- Saphenous vein harvest (removing a vein from your leg) for coronary bypass surgery
- Tricuspid valve surgery

- Advantages may include:
- Less blood loss
- Lower risk of infection
- Reduced trauma and pain
- Shorter time in the hospital, faster recovery and quicker return to normal activities
- Smaller, less noticeable scars

- **Risks**
- In people for whom minimally invasive heart surgery is appropriate, risks and complications are rare. You may experience these complications, which also may occur in other surgeries:
- Bleeding
- Stroke
- Wound infection

- **Types**
- Mayo Clinic heart surgeons work with an experienced surgical team to perform minimally invasive heart surgery, including robot-assisted heart surgery and thoracoscopic heart surgery. In both types of procedures, surgeons reach your heart through small incisions between the ribs of your chest.
- **Robot-assisted heart surgery**. In robot-assisted heart surgery, the exact maneuvers performed in traditional open chest operation are duplicated by the surgeon using robotic arms, rather than his or her hands. During this procedure, your surgeon works at a remote console and views your heart in a magnified high-definition 3-D view on a video monitor.

- From the remote console, your surgeon's hand movements are translated precisely to the robotic arms at the operating table, which move similarly to the human wrist. A second surgeon and surgical team assists at the operating table, changing surgical instruments attached to the robotic arms.
- **Thoracoscopic surgery**. In thoracoscopic surgery (sometimes referred to as a mini-thoracotomy), your surgeon inserts a long, thin tube (thoracoscope) containing a tiny high-definition video camera into a small incision in your chest. Your surgeon repairs your heart using long instruments inserted through small incisions between your ribs.
- After performing a physical examination and reviewing your clinical records, echocardiogram, and CT scan, Mayo Clinic doctors will determine whether a conventional open operation or minimally invasive operation is best for you.

- **Heart valve surgery**
- Email this page to a friendShare on facebookShare on twitterBookmark & SharePrinter-friendly version
- Heart valve surgery is used to repair or replace diseased heart valves.
- Blood that flows between different chambers of your heart must flow through a heart valve. Blood that flows out of your heart into large arteries must flow through a heart valve.
- These valves open up enough so that blood can flow through. They then close, keeping blood from flowing backward.

- **Description**
- Before your surgery you will receive general anesthesia. You will be asleep and unable to feel pain.
- In open surgery, the surgeon makes a large surgical cut in your breastbone to reach the heart and aorta. Most people are connected to a heart-lung bypass machine or bypass pump. Your heart is stopped while you are connected to this machine. This machine does the work of your heart while your heart is stopped.

- Minimally invasive valve surgery is done through much smaller cuts than open surgery, or through a catheter inserted through the skin. Several different techniques are used:
- Laparoscopy or endoscopy
- Percutaneous surgery (through the skin)
- Robot-assisted surgery

- If your surgeon can repair your valve, you may have:
- Ring annuloplasty -- The surgeon repairs the ring-like part around the valve by sewing a ring of plastic, cloth, or tissue around the valve.
- Valve repair -- The surgeon trims, shapes, or rebuilds one or more of the leaflets of the valve. The leaflets are flaps that open and close the valve. Valve repair is best for the mitral and tricuspid valves. The aortic valve is usually not repaired.

- If your valve is too damaged, you will need a new valve. This is called valve replacement surgery. Your surgeon will remove your valve and put a new one in place. The main types of new valves are:
- Mechanical -- made of man-made materials, such as metal (stainless steel or titanium) or ceramic. These valves last the longest, but you will need to take blood-thinning medicine, such as warfarin (Coumadin) or aspirin, for the rest of your life.
- Biological -- made of human or animal tissue. These valves last 12 - 15 years, but you may not need to take blood thinners for life.
- In some cases, surgeons can use your own pulmonary valve to replace the damaged aortic valve. The pulmonary valve is then replaced with an artificial valve (this is called the Ross Procedure). This procedure is ideal for people who do not want to take blood thinners for the rest of their life.

- **Why the Procedure is Performed**
- You may need surgery if your valve does not work properly.
- A valve that does not close all the way will allow blood to leak backwards. This is called regurgitation.
- A valve that does not open fully will limit forward blood flow. This is called stenosis.

- You may need heart valve surgery for these reasons:
- Defects in your heart valve are causing major heart symptoms, such as chest pain (angina), shortness of breath, fainting spells (syncope), or heart failure.
- Tests show that the changes in your heart valve are beginning to seriously affect your heart function.
- Your doctor wants to replace or repair your heart valve at the same time as you are having open heart surgery for another reason.
- Your heart valve has been damaged by infection of the heart valve (endocarditis).
- You have received a new heart valve in the past, and it is not working well, or you have other problems such as blood clots, infection, or bleeding.

- Some of the heart valve problems treated with surgery are:
- Aortic insufficiency
- Aortic stenosis
- Congenital heart valve disease
- Mitral regurgitation - acute
- Mitral regurgitation - chronic
- Mitral stenosis
- Mitral valve prolapse
- Pulmonary valve stenosis
- Tricuspid regurgitation
- Tricuspid valve stenosis

- **Risks**
- The risks for any anesthesia include:
- Problems breathing
- Reactions to medications
- The risks for any surgery include:
- Bleeding
- Blood clots in the legs that may travel to the lungs
- Infection, including in the lungs, kidneys, bladder, chest, or heart valves

- The risks for cardiac surgery include:
- Death
- Heart attack
- Irregular heartbeat (arrhythmia)
- Kidney failure
- Post-pericardiotomy syndrome -- low fever and chest pain that can last for up to 6 months
- Stroke
- Temporary confusion after surgery due to the heart-lung machine
- It is very important to take steps to prevent valve infections. You may need to take antibiotics before dental work and other invasive procedures

- **Mitral valve surgery - minimally invasive**

- **Before the Procedure**
- Always tell your doctor or nurse:
- If you are or could be pregnant
- What drugs you are taking, even drugs, supplements, or herbs you bought without a prescription
- You may be able to store blood in the blood bank for transfusions during and after your surgery. Ask your surgeon about how you and your family members can donate blood.
- If you smoke, you must stop. Ask your doctor for help.

- During the days before your surgery:
- For the 2-week period before surgery, you may be asked to stop taking medicines that make it harder for your blood to clot. These might cause increased bleeding during the surgery. Some of these medicines include aspirin, ibuprofen (Advil, Motrin), and naproxen (Aleve, Naprosyn).
- If you are taking warfarin (Coumadin) or clopidogrel (Plavix), talk with your surgeon before stopping or changing how you take these drugs.
- Ask your doctor which drugs you should still take on the day of your surgery.
- Prepare your house for when you get home from the hospital.
- Shower and wash your hair the day before surgery. You may need to wash your body below your neck with a special soap. Scrub your chest 2 or 3 times with this soap. You also may be asked to take an antibiotic to prevent infection.

- On the day of the surgery:
- You may be asked not to drink or eat anything after midnight the night before your surgery. This includes using chewing gum and mints. Rinse your mouth with water if it feels dry. Be careful not to swallow.
- Take the medicines your doctor told you to take with a small sip of water.
- Your doctor or nurse will tell you when to arrive at the hospital

- **After the Procedure**
- Expect to spend 3 - 5 days in the hospital after surgery. You will wake up in the intensive care unit (ICU) and recover there for 1 or 2 days. Nurses will closely monitor that display your vital signs (pulse, temperature, and breathing).
- Two to three tubes will be in your chest to drain fluid from around your heart. They are usually removed 1 - 3 days after surgery. You may have a catheter (flexible tube) in your bladder to drain urine. You may also have intravenous (IV) lines to get fluids.

- You will go from the ICU to a regular hospital room. Your nurses and doctors will monitor your heart and vital signs until you are ready to go home. You will receive pain medicine for pain in your chest.
- Your nurse will help start activity slowly. You may begin a program to make your heart and body stronger.
- A pacemaker may be placed in your heart if your heart rate becomes too slow after surgery. This may be temporary or permanent