ROYAL AUSTRALASIAN COLLEGE OF SURGEONS

The Australasian Society of Cardiac and Thoracic Surgeons

Coronary Artery Bypass Graft Surgery

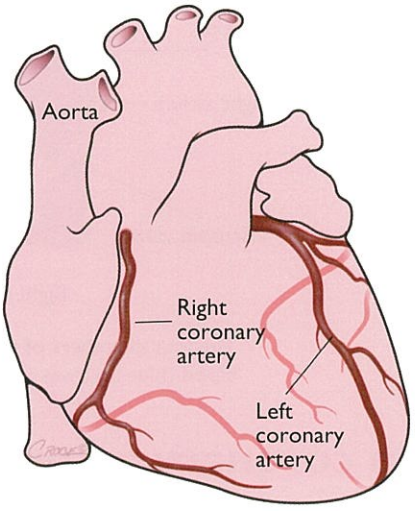
A guide for patients

The Coronary Arteries

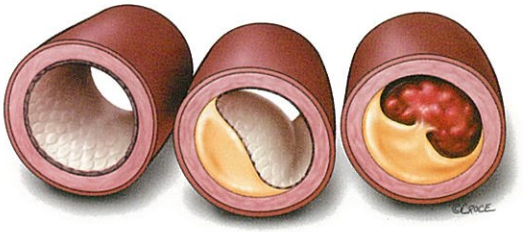
As the work of pumping blood requires a lot of energy, the heart has its own source of blood to distribute oxygen and nutrients throughout the heart muscle.

Blood is pumped to the heart muscle through the two main coronary arteries (left coronary artery and right coronary artery) that branch from the aorta and run over the surface of the heart, as shown in the illustration (right).

The left coronary artery and the right coronary artery give rise to many other smaller branches that carry blood deep into the heart muscle.



THE PROCESS OF CORONARY ARTERY DISEASE (ATHEROSCLEROSIS)



In a normal coronary artery, the inside surface is smooth.

Plaque has developed inside this coronary artery.

The coronary artery is totally blocked with plaque and a blood clot.

Coronary Artery Disease

As people age, the walls of coronary arteries often develop deposits of a fatty substance called plaque. This process is called coronary artery disease or atherosclerosis. If enough plaque is formed, blood flow through the artery will decrease significantly. Low blood flow through one or more coronary arteries can lead to recurrent chest pains (angina).

A heart attack occurs when blood flow in a coronary artery stops due to a clot that forms over the plaque. This can result in permanent damage to the heart.

Coronary Artery Bypass Grafts

When a coronary artery becomes too narrowed with plaque, it can be treated surgically by using another blood vessel to deliver blood beyond the narrowing. Such a vessel is called a graft. The procedure is called coronary artery bypass graft (CABG) surgery.

CABG surgery is an effective treatment that has been performed in millions of patients over the past 40 years. It has become a common procedure and is the most common heart surgery performed in Australia, New Zealand and other Western countries.

Outcomes for this operation in Australia and New Zealand are among the best in the world.

By restoring good blood flow to the heart, CABG surgery can stop or ease angina, improve exercise capability, and prolong life.

Improvements in surgical methods, anaesthesia and care after surgery have allowed treatment of older and sicker patients who previously would not have been eligible for a CABG procedure.

Common Grafts

The use of one to six grafts is common, but more grafts may be required in some cases.

Grafts may be arteries or veins. The most common grafts are:

- internal thoracic (mammary) arteries from the chest wall
- radial artery from the forearm
- saphenous vein from the leg.

See page three for more information about the types of grafts.

TALK TO YOUR HEART SURGEON

This pamphlet is intended to provide you with general information. It is not a substitute for advice from your heart surgeon and does not contain all the known facts about CABG surgery or every possible side effect.

It is important that you have enough information about the surgery to enable you to compare the benefits and risks. If you are not sure about the benefits, risks and limitations of treatment, the terms used in this pamphlet, or anything else, ask your surgeon.

Be sure to read all the information in this pamphlet. Some technical terms are used that may require further explanation by your surgeon. Write down questions that you want to ask, and discuss them with your surgeon. You are encouraged to fully discuss with your surgeon:

- the surgery to be done and why
- the alternatives to surgery
- the outcome you can expect.

This pamphlet should only be used in consultation with your surgeon.

IMPORTANT: Fill in all details on the sticker below.

DEAR SURGEON: When you discuss this pamphlet with your patient, remove this sticker and put it on the patient's medical history or card. This will remind you and the patient that this pamphlet has been provided. Some surgeons ask their patients to sign the sticker to confirm receipt of the pamphlet.

TREATMENT INFORMATION PAMPHLET

PROCEDURE:.....

PATIENT'S NAME:.....

DOCTOR'S NAME:.....

EDITION NUMBER:.....DATE: (day).....(month).....(year).....

Edition number: 2

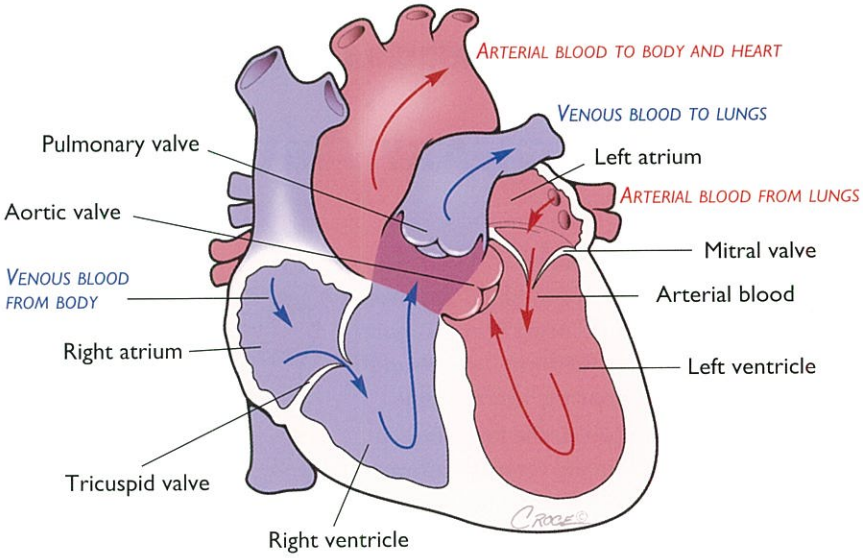
How the heart works

The heart is divided into four chambers, as shown in the figure. Valves located between the chambers allow the blood to flow in one direction. About the size of a fist, the heart lies in the centre of the chest behind the breastbone.

The purpose of the heart is to pump blood to itself, the lungs and the rest of the body. The right ventricle pumps venous (oxygen-depleted) blood to the lungs, with arterial (oxygen-rich) blood then flowing back to the left side of the heart.

The left ventricle pumps arterial blood through the aorta and then to all parts of the body. The first organ to be supplied is the heart itself.

Venous blood returns to the right side of the heart, and the process starts over with each heartbeat.



The four chambers of the heart and the direction of flow of venous blood (blue arrows) and arterial blood (red arrows).

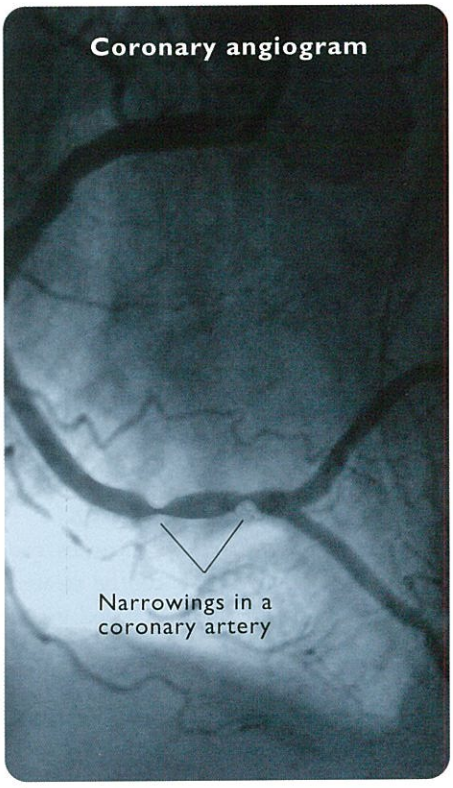
Diagnosis of narrowings in coronary arteries

Prior to surgery, you will have a full cardiac evaluation. This usually includes an ECG (electrocardiogram), chest X-ray examination, and cardiac catheterisation (to examine your heart internally). Other tests may also be required.

Cardiac catheterisation allows an X-ray examination of the heart using special dyes that show up when exposed to X-rays. During cardiac catheterisation, a fine tube (catheter) is inserted into a large artery (usually the femoral artery in the groin) and advanced into the heart. This allows imaging of the coronary arteries (coronary angiogram), imaging of the pumping action of the heart (a ventriculogram), and imaging of the aorta (an aortogram). At the same time, various pressure measurements around the heart can be obtained.

Your surgeon needs a "map" that shows the coronary arteries and the location of the narrowings. A coronary angiogram is the test most frequently used to obtain this information.

These tests may discover some narrowings that are very minor or in tiny arteries. Such narrowings do not need to have a bypass graft.



COSTS OF SURGERY

Your surgeon can advise you about coverage by public health insurance, private health insurance and out-of-pocket costs. You may want to ask for an estimate that includes medical and hospital fees, and other items. Ask which costs can be claimed on public or private health insurance. As the actual surgery may differ from proposed surgery, the final account may vary from the estimate. It is better to discuss costs with your surgeon before surgery rather than afterwards.

Interpreter Service

If you have trouble reading English, telephone the translating and interpreting service. ***Australia:*** Translating and Interpreting Service (T.I.S.) 13 14 50 (national number). ***New Zealand:*** Interpreting and Translation Services 09 276 0014 (Auckland).

ITALIAN: Se avete difficoltà nel leggere in inglese, telefonate al servizio interpreti e traduttori. Australia:13 14 50 Nuova Zelanda: 09 276 0014

GREEK: Αν δυσκολεύεστε να διαβάσετε αγγλικά, τηλεφωνήστε στην υπηρεσία διερμηνέων μεταφραστών. Αυστραλία: 13 14 50 Νέα Ζηλανδία: 09 276 0014

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TONGAN: Kapau 'oku 'ikai ke mahino ho'o lau he lea fakapapalangi, telefoni ki he kautaha liliulea mo fakatonulea. 'Aositelelia: 13 14 50 Nu'usila: 09 276 0014

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ARABIC: إذا وجدتم صعوبة في قراءة الإنجليزية اتصلوا بخدمة الترجمة الخطية والشفوية على الرقم 13 14 50 في استراليا و 09 276 0014 في نيوزيلاندا

VIETNAMESE: Nếu quý vị gặp khó khăn khi đọc tiếng Anh, điện thoại cho dịch vụ thông ngôn và phiên dịch. Tại Úc: 13 14 50 tại Tân tây lan: 09 276 0014.

Possible Complications of CABG Surgery

As with all surgical procedures, CABG surgery does have risks, despite the highest standards of surgical practice. While your surgeon makes every attempt to minimise risks, complications can occur, and some may have permanent effects.

It is not usual for a surgeon to outline every possible or rare complication of the operation. However, it is important you have enough information to fully weigh up the benefits and risks of surgery. Most people having surgery will not have a complication, but if you have concerns about possible side effects, discuss them with your surgeon.

The following possible complications are listed to inform and not to alarm. There may be others that are not listed.

General risks of surgery

- Wound infection: All surgery has a risk of infection, which can occur some days or weeks after the operation. Infection can usually be treated effectively with antibiotics.
- Blood clots: A blood clot may form in a deep vein, most often in the leg or thigh (deep venous thrombosis). This can be life threatening and requires treatment.
- Scarring: Most incisions heal well, but a few people develop raised or widened scars. Infection in the wound or areas of movement increase the risk of adverse scarring.

Specific risks of CABG surgery

- Mortality: Overall, the mortality in Australia and New Zealand is about one or two patients for every 100 CABG procedures. However, the risk of not having the surgery can be associated with a higher risk of dying. The risk of death (or serious complications) increases with increasing age, other serious illnesses, heart damage, urgency of operation, and recurrent surgery.
- Stroke: The risk of stroke (or a cerebrovascular accident) increases significantly with age and disease of the aorta, but is an uncommon complication. The effects of stroke may be temporary and resolve over a few days, or may be permanent and include:
  - loss of feeling or sensation in a part of the body
  - speech difficulty
  - visual disturbances
  - paralysis of one side of the body or arm or leg (the paralysis may be complete or partial).

Most people with stroke related to CABG surgery will require some degree of rehabilitation, either as an in-patient or out-patient.

- Infection of the breastbone: Treatment of infections of the breastbone usually require re-hospitalisation, prolonged administration of antibiotics and often surgery.
- Non-healing of the breastbone: Uncommonly, the incision in the breastbone may not heal normally. This is more likely following protracted coughing after the surgery. In some cases, the wire sutures in the breastbone may pull out. Some of these patients may need to have further surgery to repair the breastbone. This complication can also be caused by infection of the breastbone.
- Bleeding: This is the most common complication. About five patients in 100 require further surgery to control excessive blood loss. In most cases, this resolves well with no further adverse effects.
- Arrhythmia (irregular beating of the heart): The most common arrhythmia in the postoperative period is atrial fibrillation, which can affect up to one in three patients in the first week. It is usually treated with medication. Occasional extra beats are also common and not a cause for concern. Uncommonly, a serious irregular rhythm can occur and may require an electrical shock to correct it. If you feel palpitations after you go home, speak to your cardiologist. If the palpitations do not subside after a few minutes or if you are feeling unwell or dizzy, call an ambulance.
- Graft failure or blockage: A graft may not successfully bypass a narrowing or blockage. The graft may become blocked with a blood clot, leading to a heart attack after surgery.
- Heart attack or damage to the heart muscle: Even if the graft does not fail, occasionally heart damage or a heart attack can occur.
- Mood swings: It is common for patients to have some anxiety and loss of confidence related to their heart and general health, but this usually improves during the weeks following surgery.
- Removal of the radial artery: A few patients experience temporary sensations of numbness and tingling at the back of the thumb near the wrist. Hand function is not affected.
- Removal of the saphenous vein: Removal of this vein may cause swelling and aching of the legs. You may need to wear special stockings to reduce the swelling. Small nerves near the vein may be injured, resulting in decreased sensation or skin numbness in the affected leg. Some patients report that they have more pain and discomfort from the leg wound than the chest wound.
- Cognitive function: Many patients have some impairment of short-term memory, difficulty with concentration and reading, and visual blurring. As such symptoms usually occur during the first few weeks, driving is not allowed for four to six weeks after CABG. It not unusual for six to nine months to pass before symptoms resolve completely.
- Chest wall pain: Persistent pain from the healing breastbone and ribs.
- Other risks: Although uncommon, numerous other risks of CABG surgery exist, including:
  - temporary or permanent kidney failure
  - respiratory failure and the need for a tracheostomy
  - blood infection
  - permanent pacemaker due to changes in heart rhythm
  - accumulation of fluid around the heart and in lung cavities that may require further drainage
  - accumulation of air in the chest (pneumothorax), requiring temporary tube drainage.
- Graft occlusion: Over several years, one or more grafts may become occluded. Also, coronary artery disease may progress in grafted or ungrafted arteries. Reoperation may be necessary.

REPORT TO MEDICAL STAFF

Tell medical staff at once if you develop any of the following after discharge:

- fever (more than 38°C) or chills
- bleeding from the surgical area
- wound that drains for more than a day
- increasing pain or redness of a wound
- any concerns you may have about the surgery.

YOUR SURGEON

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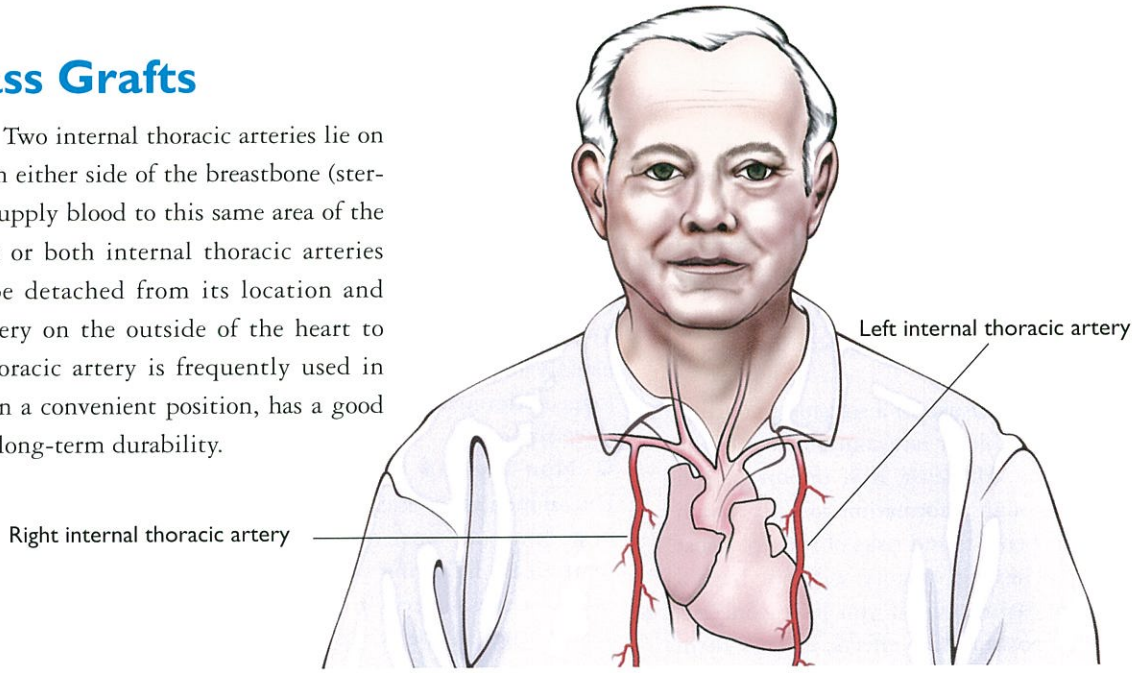
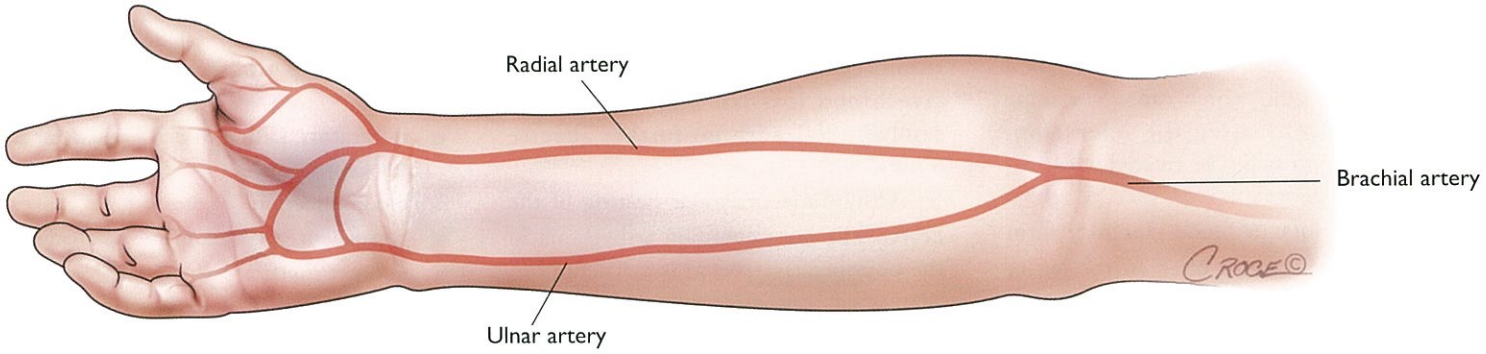
Types of Bypass Grafts

Internal thoracic artery graft: Two internal thoracic arteries lie on the inside of the chest wall on either side of the breastbone (sternum). As other arteries also supply blood to this same area of the chest, the lower part of one or both internal thoracic arteries (usually the left one) can be detached from its location and reattached to a coronary artery on the outside of the heart to bypass a narrowing. The thoracic artery is frequently used in bypass surgery because it is in a convenient position, has a good blood flow, and has excellent long-term durability.

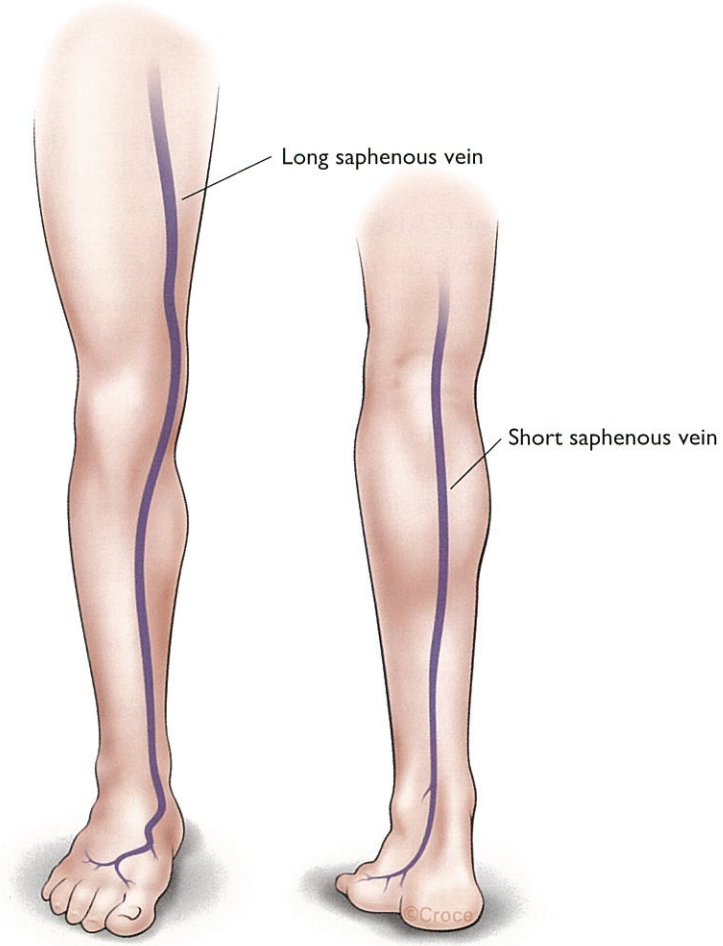


Radial artery graft: The radial artery from the forearm may be used as a bypass graft. The surgeon will determine whether it is safe to remove part of this artery. Its removal usually does not affect blood flow to the hand because blood also flows through the ulnar artery, as shown below.



Saphenous vein graft: The greater saphenous vein of the leg is frequently used as a bypass graft because it is long, straight and strong. Due to its length, it can be used for more than one graft. Even though veins have thin walls, the saphenous vein is strong enough to withstand arterial pressure. Blood flow in the leg is usually not affected by removal of the saphenous vein.

Gastroepiploic and inferior epigastric artery grafts: The gastroepiploic artery runs near the stomach, and the inferior epigastric artery runs within the layers of the abdominal wall. While useful in some cases, they are not used often.



Anaesthesia

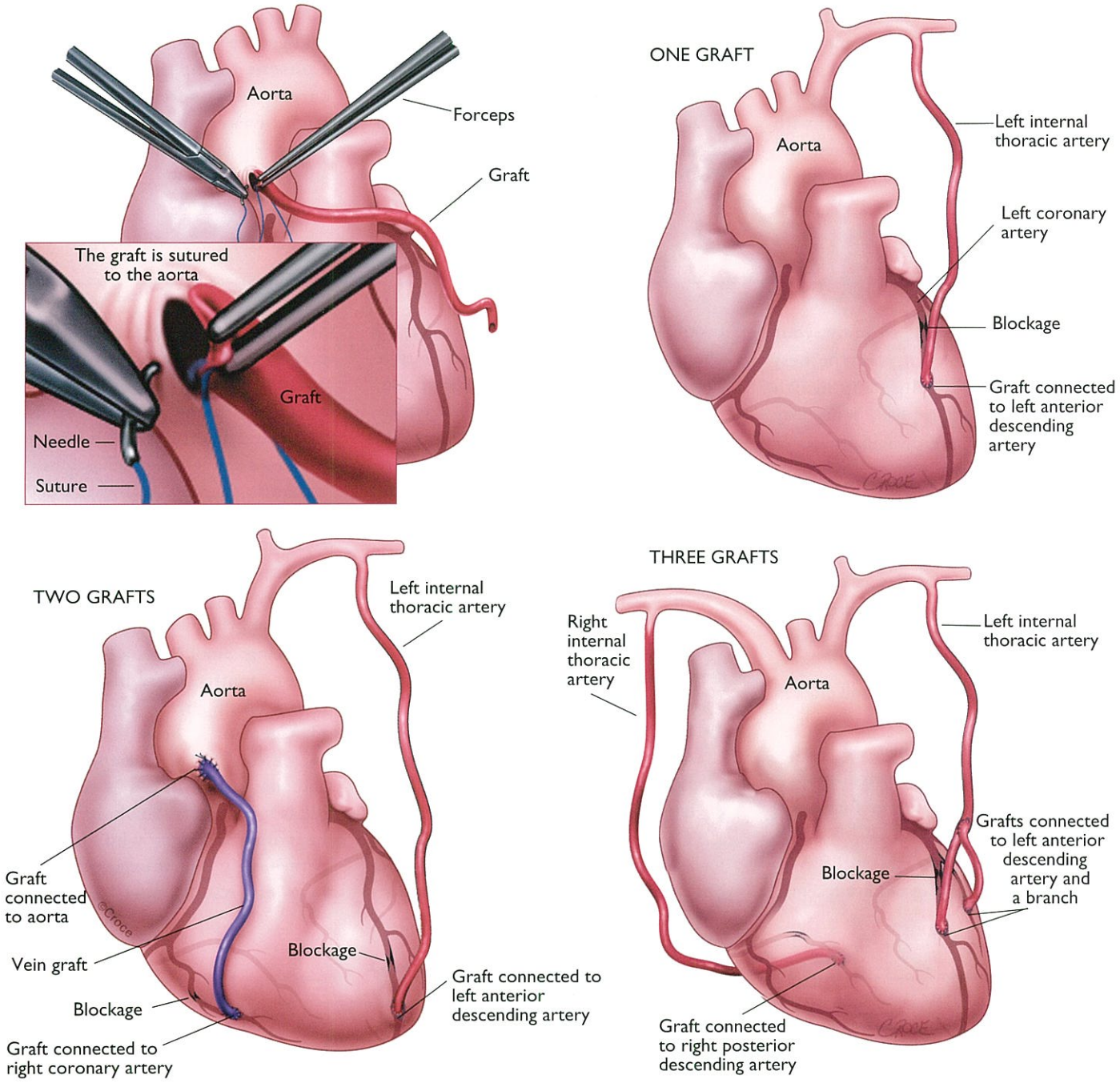
CABG surgery is performed under a general anaesthetic given by a specialist anaesthetist. Your anaesthetist will speak to you before surgery.

Modern anaesthetic drugs are safe with few risks. However, a few people may have serious reactions to them.

If you have ever had a reaction to an anaesthetic drug or any other drug, tell your anaesthetist or surgeon.

Your anaesthetist can explain more about the type of anaesthetic that is best for you and the benefits and risks.

Coronary Artery Bypass Graft Surgery



The above procedures are examples of the various types of bypass grafts that may be used by your surgeon. Your surgeon can explain which grafting procedure is best in your case.

The length of the breastbone (sternum) is cut and opened to allow access to the heart. The soft tissues in front of the heart are parted, and the membrane surrounding the heart (pericardium) is opened.

Meanwhile, the grafts are harvested and prepared. Before the surgeon attaches grafts to their new positions, the beating of the heart is stopped, and a heart-lung machine takes over the pumping of blood to the head and body; this is called "cardiopulmonary bypass".

With the heart still, the surgeon is able to connect all the grafts into their proper position using tiny stitches (sutures). The blocked section of coronary artery is not removed. If an internal thoracic artery is used, it usually remains attached at its origin, and the cut end is joined to the coronary artery past the blockage.

After connecting the grafts, the surgeon restarts the heart and removes the heart-lung machine, allowing blood to be pumped through the heart and lungs again.

The surgeon checks that blood is flowing through the grafts and stops any bleeding from various tissues. Tubes are placed within the chest to drain blood and fluid, which tend to collect during and after surgery.

The breastbone is usually closed with strong stainless-steel wire (which is left in place), and skin is closed with sutures or clips. CABG surgery usually takes from three to five hours.

OPCAB surgery: In some cases, cardiopulmonary bypass is not used, and the surgeon performs the grafting while the heart remains beating. This is called "off-pump coronary artery bypass" or OPCAB.

The Decision to Have Surgery

The decision to have CABG surgery should only be made after discussion with your heart specialist and heart surgeon. The decision is yours and should not be made in a rush. Make the decision only when you are satisfied with the information you have received and believe you have been well informed. Keep in mind that your surgeon cannot guarantee that the surgery will meet all of your expectations or that the surgery has no risks.

We encourage you to seek the opinion of another surgeon if you are uncertain about your surgeon's advice.

Realistic expectations: Patients should have realistic expectations about what CABG surgery can achieve. Not everyone will get the same results.

Consent form: If you decide to have surgery, your surgeon will ask you to sign a consent form. Read it carefully. If you have any questions, ask your surgeon.

Before Surgery

Your surgeon needs to know your medical history to plan the best treatment. Fully disclose any health problems you may have had. Some may have an effect on surgery, anaesthesia or aftercare.

Before surgery, tell your surgeon if you have had:

- an allergy or bad reaction to antibiotics, anaesthetic drugs or other medicines, surgical tapes or dressings
- prolonged bleeding or excessive bruising when injured
- previous problems with blood clots in the legs or lungs
- recent or long-term illness
- psychological or psychiatric illness
- poor healing or bad scar formation after previous surgery.

Give the surgeon a list of ALL medicines you are taking or have recently taken. Include medicines prescribed by your family doctor and those bought "over the counter" without prescription, including vitamins and herbal therapies. Also include medicines (such as insulin, warfarin or contraceptive pills) that are taken for long-term treatments.

Medicines that can increase the risk of bleeding include:

- aspirin and medicines containing aspirin (such as some cough syrups)
- low-molecular-weight heparins (such as Clexane and Fragmin)
- anti-inflammatory medicines (often used to treat arthritis)
- anti-platelet drugs other than aspirin, such as Plavix, Persantin, Asasantin, Iscover and Ticlid
- large doses of vitamin E.

These medicines are often withheld for a period of time before your surgery, but they can also form an important part of your medical management, and cessation of some of them may not be advisable. Your surgeon will advise of their use prior to your operation. Please feel free to ask your surgeon any questions about your medications.

Antibiotics or small doses of blood-thinning agents may be prescribed prior to surgery.

An exercise and rehabilitation plan designed for your needs will be discussed with you before and after the surgery.

Smoking: Smoking is a leading risk factor in coronary artery disease, and quitting is an important part of the medical management of heart disease. Smoking increases surgical and anaesthetic risk and should be stopped as early as possible before surgery. Smoking also impairs healing. Smokers who do not quit permanently cannot expect to have good long-term results from CABG surgery.

Recovery from Surgery

After surgery, you are cared for in an intensive care unit. As you recover, you will be transferred to a postoperative ward and attended by specially trained nurses and physiotherapists until you are ready for discharge.

Your physiotherapist will start you on a simple exercise program, including deep-breathing exercises and coughing. Coughing and exercise reduce the risk of pneumonia, improve circulation, and do not disturb the breastbone incision.

The drainage tubes in the chest are removed when no longer required. You are discharged from hospital when your surgeon is happy with your progress and usually when you are able to move about without assistance.

Most people need about three months to recover fully. Those who work in non-labouring jobs may be able to return to work in six to eight weeks. It is important to gradually increase your activities to help your recovery. Your doctor may recommend walking or swimming to help you regain your strength. Do not lift heavy weights (including small children) or drive until approved by your doctor.

After CABG surgery, patients report a variety of problems that usually resolve over time, such as tiredness, blurred vision, nausea and poor appetite, poor concentration, memory loss, constipation or sleep disturbances.

Pain relief: Advances in pain relief after CABG surgery have been significant in recent years, and a variety of methods are available. This is best discussed with your anaesthetist. After the first few days, tablets (such as paracetamol and codeine) are usually sufficient for pain relief.

Risk factors: After CABG surgery, the risk of recurrent angina can be reduced by:

- limiting the amount of fat, cholesterol and salt in your diet
- reducing food intake (calories)
- maintaining an appropriate weight
- undertaking a prescribed exercise program
- good control of blood pressure
- not smoking.

The risk of recurrent blockage of grafts or progressive coronary artery disease is usually less if coronary risk factors are minimised. Your surgeon or cardiologist may recommend that you join a cardiac rehabilitation program to assist you in making these lifestyle changes.

Be sure to take any medication you have been prescribed for heart problems, high blood pressure, blood cholesterol or clot prevention.