

What is Open Heart Surgery?

by Dr Dave Harris

Last fall, I gave a talk at the AGM of POHA. I thought it was important to explain, in general terms, the anatomy and physiology of the cardiovascular system and give a brief description of Open Heart surgery.

I realized that I had an advantage over most of the members because I attended medical school and had more of an understanding of the cardiovascular system. I was asked to put that information into an article hoping for a larger audience.

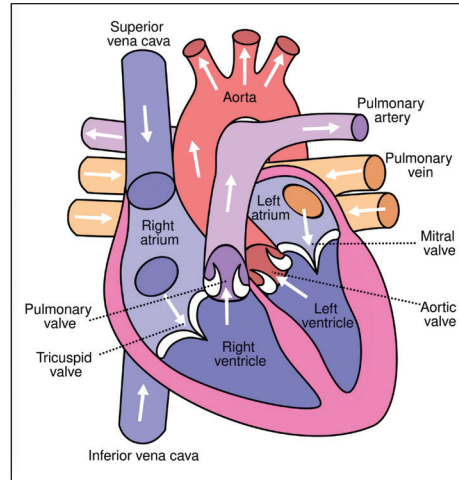
Cardiovascular System

The cardiovascular system has a pump and two sets of blood vessels.

The heart is the pump. It has four chambers; two smaller chambers called atria and two larger chambers called ventricles. These chambers are divided into a left side and a right side. The right atrium and ventricle collect deoxygenated blood from the body and pump this blood through the lungs. The left side of the heart receives and pumps oxygenated blood to the body.

The valves of the heart ensure that blood flows through the heart in one direction. The pressure in the left ventricle is five times as high as the pressure in the right ventricle. The muscle wall of the left ventricle is much thicker than that of the right ventricle.

The vascular system involves arteries that transport oxygenated blood and veins that return deoxygenated blood to the heart. The arteries start at the heart, as one large vessel called the aorta, and branch out throughout the body. Blood returns to the heart in veins. Veins from the lower half of the body feed into a large vessel called the inferior vena cava. Veins from the



upper part of the body feed into the superior vena cava. Both vena cava empty into the right atrium.

When the heart contracts, the two atria contract before the ventricles. The right atrium passes blood through the tricuspid valve into the right ventricle. The left atrium passes blood through the mitral valve into the left ventricle. When the ventricles contract, blood is passed through the pulmonary valve into the pulmonary artery and through the lungs. The blood in the left ventricle enters the aorta through the aortic valve. The oxygenated blood flows into the arterial system which branches out to the smallest vessels called capillaries. It is in the capillaries that the exchange of oxygen and carbon dioxide occurs. The capillaries also supply nutrients to the tissues and pick up waste. Capillaries then blend into veins and coalesce into larger veins that bring deoxygenated blood back to the heart.

The blood in the capillaries of the lung pick up oxygen and release carbon dioxide.

Blood vessels of the heart

The arteries and veins that supply the heart muscle are on the surface of the heart. There are two main heart arteries

called coronary arteries. The left and right coronary arteries. Both of these arteries originate on the aorta, close to the aortic valve. The coronary veins run along side the coronary arteries and drain into the right atrium.

Heart surgery

The term Open Heart surgery refers to all heart surgery that requires the chest to be opened before the surgery can be performed. For our purposes there are two main categories of heart surgery. Coronary artery bypass surgery and valve repair or replacement.

Almost all heart surgery requires that the patient be put on a heart-lung machine so the heart can be stopped during the procedure.

Heart-lung machine

These machines are complex and very sophisticated. They add oxygen and remove carbon dioxide from a patient's blood, while maintaining a constant temperature and flow rate to keep the patient alive during surgery. The machine has to be primed to ensure no air enters the system. If the patient's blood count is normal, a colloidal solution is used to prime the machine. If a patient's blood count is low, donor blood is used.

A highly trained technician operates the machine and works with the surgeons to make sure the patient is stable during the procedure.

A patient's deoxygenated blood enters the machine via a cannula that is inserted into the vena cava. Oxygenated blood is returned to the patient via a cannula inserted into the patient's aorta just beyond the aortic valve. During surgery the heart is stopped and the heart lung machine takes over the function of the heart.

Continued overleaf...

Volunteer Visitors are needed. Visits take one to two hours; a flexible schedule is available. Training and support is provided by a team leader and hospital staff. If you are interested, contact a POHA team leader for more information: **Nancy Farrell** • 604-442-7565 for St. Paul's Hospital. **Alfred Buchi** • 604-581-5508 for Vancouver General Hospital. **Mike Martin** • 604-535-3195 for Royal Columbian Hospital. **Ron Paley** • 604-463-8815 for Feeder Hospitals. ♥



Bypass surgery

If any branch of the coronary artery is blocked, the heart muscle supplied by that artery will die. This is called a myocardial infarction. If the artery is partially blocked, then muscle supplied by that artery will not receive enough oxygen. The result will be heart pain called angina.

If this is recognized in time, the partial obstructed artery can be opened with coronary angioplasty and insertion of a stent. If a stent cannot be used, then the obstruction can be surgically bypassed.

Bypass surgery can be done using veins or arteries harvested from the patient, or by using an artery in the chest wall called the internal mammary artery. If this is used, one end remains attached. The free end is attached to the coronary artery just beyond the obstruction.

Veins used for bypass are harvested from a patient's leg. One end of the vein is attached to the aorta. The other end is attached to the coronary artery just beyond the obstruction. When a section of artery from a patient's arm is used, it is attached in the same way.

When the surgeon is sure that a bypass is working and there is no bleeding at the anastomoses, the heart is restarted and the heart-lung machine is disconnected.

Heart valve surgery

The blood pressure of the left heart is five times as high as the blood pressure in the right heart. That is why almost all heart valve surgery involves the aortic or mitral valves. Whenever possible, a defective valve is surgically repaired. When repair is not possible, the valve is replaced.

There are two types of heart valve. Originally mechanical valves were used. Although there have been improvements in the design and structure, mechanical valves are the most used. The second type of valve is called a tissue valve. It is made using tissue from cow, or pig heart valves. A cow tissue valve is made using the pericardium of a cow's heart to make leaflets. Pig valves are made using the actual leaflets of the aortic valve of a pig heart.

In both types, the three leaflets are matched according to size and sewn on a rigid ring covered with a fabric. These valves are made in different sizes and a surgeon will decide which size to use in a particular patient.

When a mechanical valve is used, the patient is put on anticoagulants for life. Frequent blood tests are required. Mechanical valves can function for an indefinite

duration. Tissue valves do not require the patient to take anticoagulants but will only last about ten years.

The age of a patient is the main criteria when choosing what valve to use. More and more younger patients are electing to have a tissue valve, to avoid the use of anticoagulants, knowing that they may eventually need to have their tissue valve replaced with a mechanical valve.

A few words about cholesterol

Cholesterol is a waxy substance found in every cell of the human body. It is essential for all cell membranes and is the building block for several hormones. There are two sources of cholesterol in our body. All the cholesterol we need is manufactured in the liver. Cholesterol in our diet also enters our body.

Cholesterol is not soluble in water. It must be attached to substances called lipoproteins to be transported in blood. There is only one cholesterol but there are two main types of lipoproteins; high density lipoprotein (HDL) and low density lipoprotein (LDL).

High LDL levels in the blood are a major cause of plaque build-up in arteries. This can occur in any artery in the body. LDL is referred to as "bad cholesterol." HDL can lower LDL level and is referred to as "good cholesterol."

The factors that determine cholesterol levels include diet, exercise and family history. It is important that everyone has their cholesterol levels checked. If the LDL is elevated, treatment should be initiated. There are medications available to help lower LDL levels. Some medications reduce the liver production of cholesterol. Others reduce the absorption of cholesterol in the intestine. This is especially important for people who have coronary artery disease, or who are at risk of developing it. ♥

Welcome to the Pacific Open Heart Association (POHA)

We provide a volunteer hospital visitation program where our teams of members visit heart patients at St. Paul's Hospital, Vancouver General Hospital and Royal Columbian Hospital.

In addition, we visit heart patients who are waiting in Lower Mainland hospitals for transfer to a surgery hospital. We offer non-medical advice, and encouragement before, and after, surgery.

Membership is open to all persons who are waiting for or have undergone cardiovascular-related procedures and to their respective spouses and children.

Additionally, interested members of the general public may, upon application, be entitled to membership.

Your support matters

POHA donates to the cardiac hospital wards each year for the purchase of equipment and other resources. Your support helps us achieve our greater mission of raising awareness, and providing guidance and support to the community.

Membership

Most of you receiving this newsletter will have paid your 2026 POHA membership. If you have not, please visit our website and pay online. A one-year membership costs ten dollars. ♥



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Pacific HeartBeat is published semi-annually by POHA. Editors: Mike Martin and Patrick Hagan.

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