

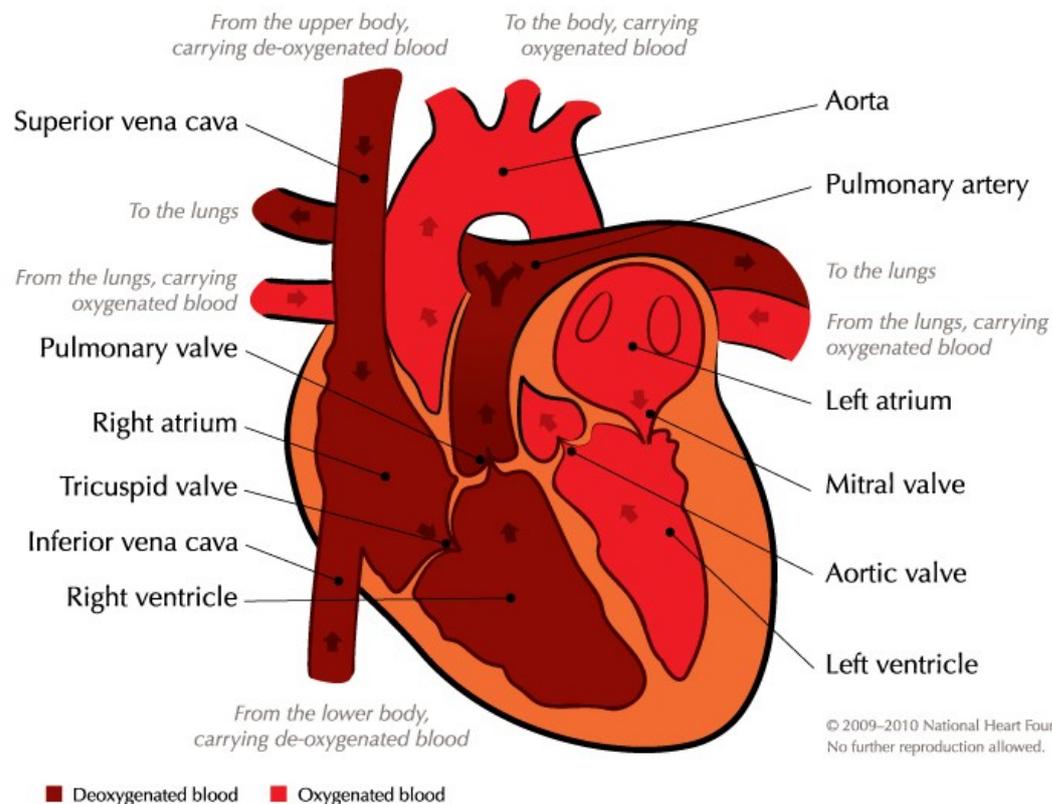
## Artificial hearts

Your heart is a muscle that pumps blood around your body. It has four chambers:

- the left and right atria (blood receiving chambers)
- the left and right ventricles (the blood pumping chambers).

Blood in the right ventricle (right heart) is pumped into the pulmonary artery and on to your lungs. Blood in the left ventricle (left heart) is pumped into the aorta and through to your body.

### Your heart



Blood from your body is received via the superior vena cava (SVC) and the inferior vena cava (IVC) into the right atrium (RA). It then passes from the right atrium into the right ventricle (RV) and is subsequently pumped via the pulmonary artery (PA) into your lungs. In the lungs, blood is enriched with oxygen and carbon dioxide is removed from it.

Blood from your lungs is received by the left atrium (LA) and passes into the left ventricle (LV) from where it is pumped via the aorta into your body. It supplies oxygen and nutrients to the different cells in your body.

When your heart isn't pumping enough blood around your body because your heart is severely failing, you may need an artificial heart.

## What is an artificial heart?

An artificial heart is a mechanical device, about the size of an orange, that is connected to your heart or implanted in your chest to help or replace a failing heart. It may have several valves, a mechanism to propel blood forward, and one or more chambers.

Sometimes an artificial heart may help your heart temporarily, until yours recovers. If this is the case, the artificial heart will be removed when it is no longer needed. More commonly, when there is irreversible heart muscle damage and your heart can't recover, the artificial heart stays until you can have a heart transplant. If no other options are available, an artificial heart may completely and permanently replace your heart.

There are two types of artificial heart.

**An artificial heart that provides an extra ventricle** (pumping chamber in your heart) to help to pump blood around your body. This is called a 'ventricular assist device' (VAD).

A VAD is made from metal and plastic, and has a small pumping chamber lined by a special material that stops blood clots forming. It may be put into your body or lie outside your body, depending on what type of artificial heart is being used.

A VAD may be connected to you in various ways depending on if it needs to support the left side of your heart, the right side of your heart or both sides of your heart (see Figure 1).

- If it needs to support the left side of your heart, it is attached to the left atrium/ventricle and the aorta, and is called a 'left ventricular assist device' (LVAD) (see Figure 1A). Blood is received into the device from the left ventricle (LV) and is pumped into the aorta.
- If it needs to support the right side of your heart, it is attached to the right atrium and pulmonary artery, and is called a 'right ventricular assist device' (RVAD) (see Figure 1B). Blood is received into the device from the right atrium (RA) and is pumped into the pulmonary artery (PA).
- If it needs to support both sides of your heart, it is attached in both of the above ways and is called a 'biventricular assist device' (BiVAD) (see Figure 1C). This is a combination of a left ventricular assist device (LVAD) and a right ventricular assist device (RVAD).

Figure 1

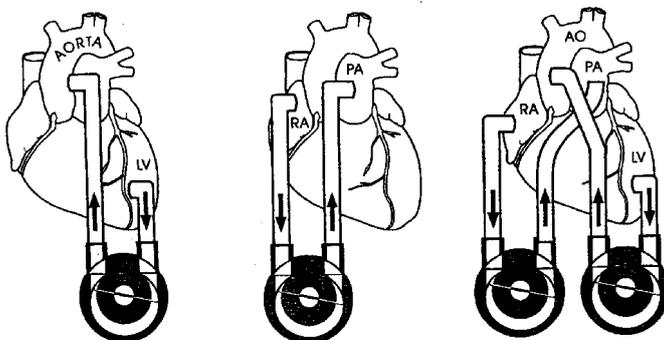


Figure 1A

Figure 1B

Figure 1C



**Total artificial hearts** (TAH) are a mechanical substitute for your entire heart. They are put into your body after your heart has been removed.

## How does an artificial heart work?

Blood enters an artificial heart from the left or right atrium (blood receiving chamber). It is then pumped into the aorta (artery to your body) or pulmonary artery (artery to your lungs), depending on which side of your heart is being supported.

An artificial heart is powered by either compressed air or electricity. A thin cable connects the pumping chamber to a control console that regulates the pump function. The control console can be a large box on wheels that stays beside you, moving with you when you walk around the hospital. It can also be much smaller, with attachable batteries, and worn on a belt or vest. The smaller console gives you more freedom and mobility than the large console, and may make it possible for you to leave hospital.

## Do I need an artificial heart?

If you have severe heart failure and your heart can't pump enough blood around your body to keep it working, you may need an artificial heart.

Your heart may fail because:

- your heart muscle is diseased (cardiomyopathy)
- you have coronary heart disease (disease of the arteries to your heart), which has caused a very large heart attack, or more than one heart attack
- you have a severe viral infection of your heart (myocarditis)
- you have another less common disease that affects your heart.

Your doctor will give you medicine to support your heart and help it to work better. If medicine doesn't help your severe heart failure, you might need to have a heart transplant (for more information, visit our website at [www.heartfoundation.org.au](http://www.heartfoundation.org.au) or call our Health Information Service on 1300 36 27 87).

If you have severe heart failure, your cardiologist might recommend that you use an artificial heart until a donor heart becomes available. When a suitable donor heart becomes available and you are well enough, the artificial heart will be removed during the transplant operation.

Between 20 and 30 people are given artificial hearts each year in Australia. Most artificial hearts are used until a donor heart becomes available. However, a small number are used permanently in people who aren't suitable for a heart transplant.

## How long does an artificial heart last?

If you are just using an artificial heart until you have a heart transplant, your artificial heart will usually function until you have the transplant. This can range from a few weeks to more than one year.

If you need a total artificial heart permanently because you are not suitable for a heart transplant, an artificial heart may last for several years.

## What will happen before and after I get an artificial heart?

Before you are given an artificial heart, you will be carefully examined by your doctor to make sure that you are suitable for the artificial heart and, in most cases, for the heart transplant afterwards. If you have other major medical problems, such as kidney, lung or liver disease, infection or cancer, you may not be suitable for an artificial heart.

Once you have an artificial heart, you will be closely monitored in the intensive care unit of your hospital. Your care will be very similar to that given to people who have other cardiac surgery. Your cardiologist will pay particular attention to how your artificial heart is working and to preventing infection. They will also give you medicine, such as aspirin and/or warfarin, to thin your blood to stop blood clots forming.

You will probably be very sick before you are given an artificial heart, but your condition should improve in the weeks after you receive it. You will eventually be able to walk around the hospital and be physically active while you have the artificial heart. You might even be allowed to go home while you wait for your donor heart transplant.

## Are there any complications with artificial hearts?

Artificial hearts are very reliable and mechanical failure is extremely rare.

Complications that may occur if you have an artificial heart include bleeding and infection. Major organs, such as the kidneys, liver or lungs may also fail, but these organs may have started failing before you received the artificial heart.

Everyone who has an artificial heart must take medicine to thin their blood (anticoagulants). This helps to stop blood clots forming and potentially causing a stroke if the blood clot moves to the brain.

Not everyone who has an artificial heart will recover enough to have a donor heart transplant. Some people will die of the complications mentioned above.

It is very rare for someone to recover enough to have their artificial heart removed and not have a donor heart transplant.

## What research is being done into artificial hearts?

Research is being done in several areas to improve the quality and use of artificial hearts.

Researchers are looking into reducing the size of artificial hearts so that they can be totally implanted inside the chest.

Work is also being done to develop artificial heart batteries that are small, long-lasting and implantable, and which can be recharged across the patient's skin.

Biologically superior materials are being developed to reduce the tendency for blood to clot and the need for blood-thinning medicines (anticoagulants). These materials will be used to line the internal chambers of artificial hearts.



Research is also being done into stem cells, which may be used to replace damaged heart muscle cells and restore heart muscle function. If this is possible, it would prevent heart failure and ultimately reduce the need for heart transplants and artificial hearts.

## Further information

If you want to know more about artificial hearts or have any general heart health questions, call our Health Information Service on 1300 36 27 87 (for the cost of a local call) or email [health@heartfoundation.org.au](mailto:health@heartfoundation.org.au).

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