

Why do people need transplants?

WHY DO PEOPLE NEED ORGAN AND TISSUE TRANSPLANTS?

Everyday people need transplants, from the very young to the very old. This can be the last resort of lifesaving treatment or for life-improving treatments. This opportunity only becomes available, when someone donates their organs or tissues upon their death. The next of kin can make the choice to donate if the individual's wishes aren't known.

Some people need transplants because:

- they were born with a **structural abnormality** of an organ such as a congenital heart defect or biliary atresia. Biliary atresia is one of the most common reasons that a child might require a liver transplant – the bile duct has failed to develop.
- they were **born with a disease** that causes an organ to fail. This might be an inherited disorder such as cystic fibrosis.
- they have been unlucky enough **to develop a disease or illness** that caused an organ to fail. For some people, simply catching a cold or flu can result in them requiring a heart transplant for cardiomyopathy, a disease that severely affects the heart muscles' ability to contract.

In some respects, people with kidney failure are a little more fortunate. A dialysis machine can take over some of the functions of the kidney while they wait for their transplant. People with diseases affecting their heart, lung, liver or pancreas do not (at this stage) have biomedical devices available to them to replace the functions of their failed organs. A transplant is their only option.

Fact: Not everyone with end stage organ failure is suitable to receive a transplant – potential recipients are evaluated extensively and only those for whom

- Have a condition for which transplantation is considered an effective treatment;
- Have severe and progressive disease that no longer responds to medical treatment and may be fatal within a short time;
- Be willing to accept the risks of surgery and subsequent medical treatment; and/or
- Be physically and emotionally capable of undergoing surgery and subsequent medical treatment.

Fact: In Australia, a person has a 10 times greater chance of requiring an organ or tissue transplant than of becoming a donor. Organ donation is medically possible in less than 1% of all deaths that occur.

WHAT TYPES OF TRANSPLANT ARE THERE?

There are two ways people can donate –

- (1) **Organ and tissue donation after death,** and
- (2) **Living donation (while you are alive)**

(1) ORGAN AND TISSUE DONATION AFTER DEATH

Organs that can be transplanted include heart, lungs, liver, kidneys and pancreas.

Tissues that can be transplanted include eye tissue, heart valves, skin and bone tissue.

ORGAN TRANSPLANTATION

Liver transplantation

The liver is the body's largest organ and is essential in keeping it working properly – you can't live without a functioning liver. It removes or neutralises poisons, germs and bacteria from the blood and produces immune agents to control infection. It makes proteins

that regulate blood clotting and produces bile to help absorb fats and fat-soluble vitamins. In liver transplantation, surgery is performed to remove a diseased liver and replace it with a healthy liver from an organ donor. A liver transplant is necessary when disease stops the liver from working. There are more than 60 diseases of the liver for which someone may require a transplant. The most common reason for liver transplantation in adults is cirrhosis, a disease in which healthy liver cells are killed and replaced with scar tissue blocking the flow of blood through the organ and preventing it from working as it should. The most common reason for transplantation in children is biliary atresia, where the ducts that carry bile out of the liver are missing or damaged.

Lung transplantation

Every cell in your body requires oxygen to do its job. When a cell uses oxygen, it produces carbon dioxide which has to be removed quickly. In a healthy person there is a constant, steady flow of oxygen TO cells and carbon dioxide AWAY from cells and out of the body. The lungs have the important job of providing the oxygen the body needs and expelling the carbon dioxide. If the lungs are so badly damaged that even extra oxygen and artificial breathing assistance are inadequate, lung transplantation may be indicated. Lung transplantation involves removal of one or both diseased lungs from a patient and the replacement of the lungs with healthy organs from a donor. Lung transplantation may refer to single, double, or even heart-lung transplantation.

Heart transplantation

The heart is a muscle and a pump that receives un-oxygenated blood from the body. Blood enters the first two chambers of the heart and travels through the lungs, where it is oxygenated. After oxygenation, blood leaves the lungs, travels through the other 2 chambers before being ejected out of the heart to the rest of the body. When the heart muscle is injured it affects how well blood can pump around the body.

The two most common problems that damage the heart muscle are coronary artery disease and cardiomyopathy. Coronary artery disease refers to the build-up of plaque in the arteries and predominantly affects adults. When the plaque blocks an artery,

blood cannot get to part of the heart muscle which in turn, is injured. This can affect how the heart muscle contracts, or pumps. Cardiomyopathy means disease of the heart muscle. Affecting both children and adults, it damages the heart's muscle tone and reduces its ability to pump blood to the rest of the body. As these heart problems get worse, the heart grows weaker but has to work harder and is able to pump less oxygenated blood. It tries to make up for this by becoming enlarged and in time may "wear out". Some people also need heart transplants because of congenital heart defects. These are structural problems with the anatomy of the heart which cause abnormal blood flow, contraction and oxygenation.

Kidney transplantation

Healthy kidneys clean the blood by removing excess fluid, wastes and minerals. They also make hormones that regulate blood pressure and keep bones strong and blood healthy. Dialysis and drugs can replace some of these functions. There are many diseases which cause the kidneys to fail. These may be acute or chronic. Diabetes often results in renal failure. Nephropathy, meaning disease of the kidney, can also be caused by glomerulonephritis, an inflammatory kidney disease, polycystic disease, toxins produced by viruses, bacteria and some drugs and structural defects.

Pancreas transplantation

Pancreas transplantation is a treatment for patients with diabetes. It is performed to prevent, halt or reverse problems that can arise after years of living with the disease. The pancreas has cells called Islets of Langerhans which secrete insulin and control the body's sugar levels. Many people with diabetes eventually develop complications of the disease, which affect their vision, foot and leg sensation, heart and circulation, and kidney function. With advanced kidney disease, transplantation maybe an option and for this reason the pancreas is usually transplanted with a kidney. It is also possible to isolate the islet cells from the donated pancreas. These are infused into the liver and the cells secrete insulin.

TISSUE TRANSPLANTATION

Eye tissue (corneas)

Corneal transplantation is surgery to replace the clear, dome-shaped surface on the front of the eye. The cornea is the eye's outermost layer and must remain transparent to refract light properly. Corneal transplants are generally performed either to improve vision, to preserve the eye through reconstructing the cornea or to treat painful diseases or trauma.

Heart valves

These regulate the flow of blood to and from the heart, which has four chambers: two atria, or upper chambers, and two ventricles, or lower chambers. Blood passes through a valve before leaving each chamber and it is these valves that prevent the backward flow of blood. The valves are actually flaps and there are four of them – the tricuspid, mitral, pulmonary and aortic. Valves can malfunction in several ways: they may not have developed at all; the valve opening maybe too narrow; or the valve doesn't close completely. When any of these things happen, the implications for the heart can be serious, possibly hampering its ability to pump blood adequately through the body.

Malfunctioning valves can be replaced with mechanical valves or valves made from animal tissue. However, many people cannot tolerate the blood thinning medication required for these valves. For this reason, the best option for repairing heart valves is through human donation. Human heart valves are especially important for young women of child-bearing age, because they do not need drugs to maintain a healthy valve transplant and can have children without complications.

Musculoskeletal tissue

Bone is one of the most commonly donated tissues used for transplantation. The majority of donor bone in Australia is obtained from living donors -- in particular, patients undergoing elective total hip replacement. There is also a requirement for specific bones that can only be obtained from people who have died. The most common reason for bone donation is failed joint replacement surgery. But it is also needed for reconstruction following surgery for

trauma or cancer which can prevent a possible limb amputation or allow mobility and movement after trauma surgery repair. Structures that support bone and muscle, such as tendons, are also needed.

Skin

This refers to the grafting of skin from one site to another to replace a lost portion of the body surface skin. Skin functions as a protective barrier against microorganisms and has the ability to regenerate. It acts as an insulator against heat and cold, provides nutrients and helps eliminate waste in the form of perspiration. Skin is extremely important in the healing process of burns victims.

Though most transplant procedures carry the risk of rejection, this risk is markedly reduced with tissue transplants because unlike organs, tissues have a limited blood supply.

(2) LIVING DONATION

Blood donation

This is the most common donation because blood constantly regenerates. Clinical need obviously drives demand as well. A single blood donation can contribute to the formulation of up to eight different products. People who need blood transfusions include accident victims, patients undergoing surgery, organ and bone marrow transplant recipients and those undergoing treatment for leukaemia. Generally, anyone who is aged between 16-70 years, weighs at least 45 kilos, is in good health, and meets the guidelines, can donate blood.

Bone marrow

This can also be donated by a living person and regenerates in the donor. Bone marrow is the spongy tissue found inside bones. The marrow in, the skull, hips, ribs, and spine contains stem cells which produce the bone cells. These include white cells, which fight disease and infection, and red cells, which carry oxygen and platelets to enable blood clotting.

Bone marrow transplants are used to treat leukaemias, lymphomas and some cancers. Traditionally, siblings are the ideal donors for some treatments and tissue typing is very important to find the best match for the potential recipient.

Cord blood

Cord blood is the blood left behind in the placenta and umbilical cord and is usually discarded after childbirth but donation is an option. Research has shown that cord blood is rich in blood-forming stem cells known as haemopoietic stem cells. It is collected from the umbilical cord and placenta at no risk either to the mother or baby. It is tested and tissue typed before being made available for transplantation.

Kidney

Kidney donation can also be performed by a living donor. Most people have two kidneys from birth and a person can live and function normally with only one kidney.

Living kidney donation is predominantly between family members as tissue compatibility is very important. But it can also be performed from a living un-related donor such as a spouse or friend, providing they can be matched.

Bone

Bone tissue can also be donated while the donor is alive. After blood, bone is the second most commonly transplanted tissue. It has been estimated that between 200,000 and 300,000 people worldwide receive bone transplants each year; more than 25 times the number of people who undergo kidney transplants and 100 times the number who undergo heart transplants. Living bone tissue donation is usually from patients who require total hip replacement surgery, where the hip joint is replaced with prosthesis.

Is transplantation successful?

Australia boasts one of the highest transplantation success rates in the world. Kidney transplant survival rates are about 90% in the first year and over 75% in five years. Patient survival rates for heart and liver transplantation are also 90% in the first year and 85% after five years. Pancreas transplants have the highest survival rate of 94% at one year and 87% at five years.

Tissue transplantation is also extremely successful with most recipients who, at the very least, are able to enjoy improved quality of life.

How long do people wait?

Transplant waiting times vary widely and depend upon availability of suitable organs. Though waiting times for corneal grafts tend to be a few months, individuals waiting for organ transplants can wait an average of one to three years for their life saving transplant.

Milestones in the World History of Transplantation

Year	Milestone	Location
1905	Cornea (eye tissue)	New York USA
1954	Living related kidney (identical twins)	Brigham Hospital, USA
1962	First kidney transplant	Colorado, USA
1963	First liver transplant	Colorado, USA
1966	First pancreas transplant	Minnesota, USA
1967	First heart transplant	Cape Town, SOUTH AFRICA
1978	Living related pancreas (mother to child)	Minnesota, USA
1980	Sandoz Pharmaceuticals developed Cyclosporine	Anti-rejection medication – pushed success rate from 50% to over 90%
1981	First heart/lung transplant	California, USA
1984	First heart xenotransplant “Baby Fae”	California, USA
1987	First segmental liver transplant (for children)	Brisbane, AUSTRALIA
1989	First successful living-related liver transplant (mother to child)	Brisbane, AUSTRALIA
1992	First mono-segmental liver transplant (for babies)	Brisbane, AUSTRALIA
1992	Xenotransplant (Baboon's liver to human)	Pennsylvania, USA
2002	Liver transplant for youngest child in Australia (24 days) in Australia	Brisbane, AUSTRALIA
2003	First heart/lung & liver transplant in Australia	Brisbane, AUSTRALIA