Organ Transplants

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Introduction

Organ transplantation is the surgical removal of an organ from one person and its transfer to another person. Thirteen organs and types of tissue can be transplanted. They are: liver, kidney, pancreas, heart, lung, intestine, cornea, middle ear, skin, bone, bone marrow, heart valves, and connective tissue. In 2018, there were 36,528 organ transplants in the United States. Some of the reasons why a person may need a new organ include kidney failure, cirrhosis of the liver, heart failure, and hepatitis C.

Modern organ transplantation carries a high chance of long-term survival for the recipient. However, it is often a last resort after other treatments have failed. The success of an organ transplant depends on both surgical technique and effective medical treatment with immunosuppressant medication to stop the rejection of the new organ. In most countries, organ transplantation takes place within a clearly defined medical and legal infrastructure, designed to protect the best interests of both donor and recipient. Organ transplantation has become almost routine, and this has led to a high demand, particularly as the population ages and more people develop diseases for which a transplant is appropriate treatment. The supply of organs for transplant does not match this demand. In the future, the gap may be bridged by xenotransplants, stem cell therapies, and artificial organs.

Words to Know

Organ Procurement and Transplantation Network (OPTN)
The OPTN is a public-private network linking all the professionals involved in the organ donation and transplantation system. It was established by Congress in 1984 under the National Organ Transplant Act.

Cirrhosis of the liver
A group of liver conditions in which liver cells are damaged and replaced by scar tissue, thereby reducing the amount of healthy, functional liver.

Hepatitis C
A chronic liver infection with the hepatitis C virus that can lead to cirrhosis. Hepatitis C has become the leading cause for liver transplantation in the United States.

United Network for Organ Sharing (UNOS)
UNOS administers the OPTN for the United States Department of Health and Human Services.

Xenograft
A tissue or an organ from one species donated to a recipient of another species, such as from pig to human.

Historical Background and Scientific Foundations

Interest in organ transplantation dates back to the nineteenth century. However, it was not until French surgeon Alexis Carrel (1873–1944) developed a method of joining blood vessels together that transplanting organs became a realistic prospect. The transplant operation requires the blood vessels of the graft to be united with those of the recipient's body. This joining is relatively simple for the kidney and, because people can function on one healthy kidney, transplants from living donors are possible. In 1954, the first successful kidney transplant involving a living donor was performed between identical twins by Joseph Murray (1919–2012) and his team at Brigham Hospital in Boston.

Transplanting major organs other than the kidney is far more challenging. American physician Thomas Starzl (1926–2017) pioneered liver transplantation, carrying out the first operation in 1963. In the same year, James Hardy (1918–2003), of the University of Mississippi, transplanted a human lung. The first human heart transplant was performed in South Africa in 1967 by Christiaan Barnard (1922–2001). In those early days, transplantation was very risky, and patients often did not survive for long.
part, this was because the transplant was a last resort for patients who were very sick to begin with, but rejection of the new organ was also a major problem. Suppressing the recipient's immune system with drugs to reduce rejection risk met with limited success. It was not until the introduction of the immunosuppressant drug cyclosporine in the mid-1970s that organ transplants really began to fulfill their lifesaving potential. Cyclosporine was much better than earlier antirejection drugs, and there have been further advances, such as the introduction of the drug mycophenolate mofetil, which make rejection far more manageable.

Once permission has been obtained to retrieve organs for transplant, the donor is placed on a ventilator, which keeps the organs in perfect condition prior to removal. When the organs are recovered, they are stored in ice. The organ is perfused with special preservative fluids during cooling and storage. Research has led to greater understanding of how to limit the inevitable deterioration of biological tissue in the time gap between recovery from the donor to transplant into the recipient. A kidney can be kept in good condition for up to 30 hours, a liver or pancreas up to 12 hours, and the heart and lungs for only 4 to 6 hours.

Given the technical and ethical issues involved, organ transplant requires a well-organized system to coordinate supply and demand. In the United States, the system is known as the Organ Procurement and Transplantation Network (OPTN), which is operated by an organization called the United Network for Organ Sharing (UNOS). The local organ procurement organization will be notified if a potential donor is admitted to a hospital, such as a person with a severe head injury who is unlikely to survive. If the organ does become available, the procurement organization sends information to UNOS to start the tissue typing process. UNOS generates a list of potential recipients and notifies the transplant center. The transplant team then considers the organ for their patient and either accepts or declines it. If it is declined, then the next person on the list is offered the organ. Once the organ arrives at the transplant center, surgery on the recipient begins and lasts for several hours.

Impacts and Issues

Every year, organ transplants save the lives of around 36,000 people in the United States alone. Survival rates vary with the organ received and previous state of health of the patient. According to the Scientific Registry of Transplant Recipients, the five-year survival rate for heart transplant patients is about 76 percent; however, only about 52 percent of lung transplant patients live that long. Unfortunately, not all of those who need an organ transplant to save or prolong their lives can have one. UNOS states that in July 2019, there were over 113,000 people awaiting a transplant in the United States. Around 20 patients die each day while waiting to receive a new organ.

In Context: Transplant Tourism

Transplant tourism is the trade in human organs across national borders, usually by individuals traveling abroad to receive organ transplants. Organs used in such procedures often are obtained through (sometimes illegal) commercial transactions, raising ethical questions about the commoditization of human body parts. Individual recipients of these organs are more likely to come from wealthy countries such as Australia, Canada, Israel, Japan, Oman, Saudi Arabia, or the United States. These are referred to as organ-importing countries. Donors and organ sources are most likely to originate in the country in which the transplant takes place. So-called donor countries typically are developing or recently developed nations, but also include nations with low-cost good medical care or the few countries that do not ban the commercial sale of organs. The World Health Organization (WHO) identifies Bolivia, Brazil, Colombia, Egypt, India, Iraq, Israel, the Republic of Moldova, Pakistan, Peru, the Philippines, Thailand, Turkey, and South Africa as common donor or destination nations for transplant tourism.

Individuals engage in transplant tourism to obtain needed organs that may be in short supply in their home country, to reduce the cost of a needed transplant, or to avoid potentially long waits on national registries for suitable organs. Recipients may obtain organs by paying suitable living donors (for organs such as a kidney) or exploit systems permitting payment to obtain organs from deceased donors as they become available, rapidly and preferentially. The World Health Assembly adopted a 2004 resolution urging countries to take measures to protect the poorest and vulnerable groups from transplant tourism and the sale of tissues and organs. A majority of nations where transplants occur have enacted such laws, but both legal and illegal markets for organs continue to exist. India bans the trade in organs, but according to the WHO, approximately 2,000 Indians per year sold one of their kidneys, as of 2015.

The ideal donor organ comes from a healthy young person who has died from a traumatic head injury, often sustained in a road traffic accident. Improvements in road safety, such as legislation requiring the wearing of seat belts, led to a decrease in such fatalities which, in turn, reduced the supply of organs just as demand for them began to increase. However, there are various ways in which the organ supply can be increased. One possibility is for more countries to adopt an opt-out or presumed consent approach to organ
donation, instead of an opt-in approach. In the former, a person's organs can be donated for transplant unless they have explicitly stated this is against their wishes. The United Kingdom, Canada, Australia, and the United States, along with 13 other countries, use the opt-in approach, in which a potential donor must carry a donor card. As well as changing their systems, these countries could also persuade more of their citizens to take an organ donation card.

There have been some changes to the clinical status of donors. Older donors and those with certain medical conditions have come to be considered as potential candidates, whereas in earlier years they would have been deemed unsuitable. Naturally, this has led to concerns over how recipients will fare with a less-than-perfect donor organ. There has also been an increase in the number of living donors for kidneys and livers. This raises ethical issues over whether the risk to the donor of losing all, or part of, an organ may outweigh the benefit to the recipient. Also, the gap between organ supply and demand has led to an increase in organ trafficking. The sale of organs for transplant is illegal in most countries around the world. For many years it was difficult to find reliable data on the extent of organ trafficking. However, the World Health Organization asserts that it is a real and growing problem, with around ten percent of the estimated 70,000 kidneys transplanted each year having been bought illegally. People with options limited by extreme poverty or executed criminals are often the donors in such cases.

In the future, the pressure on the supply of human organs may be eased by scientific advances. Xenografts from genetically modified pigs could provide a source of donor hearts, for example. There has also been significant progress in the development of artificial hearts, which are being used in some cases as a bridge to an organ transplant, keeping the patient alive until an organ is found. Stem cells may also be able to treat parts of the body in need of repair or replacement. For instance, stem cells currently are providing a source of heart muscle cells to repair cardiac damage. Unlike organs for transplant, stem cells can be grown in limitless supply in bioreactors, with no need of donors.

Books


Siemionow, Maria Z. Face to Face: A Short History of Face Transplantation. Cham, Switzerland: Springer, 2019.

Websites


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