Introduction to Transplantation

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Overview

• Definition
• Types of Transplants
• History
Transplantation

• Refers to the act of transferring cells, tissues, or organs from one site to another.

• The process of taking cells, tissues, or organs, called a **graft**, from individual and placing them into a different individual.
• Individual who provides the graft-
  DONOR
• Individual who receives the graft-
  RECIPIENT
Definition of Transplantation

- Transplantation is the transfer (engraftment) of human cells, tissues or organs from a donor to a recipient with the aim of restoring function(s) in the body. (WHO)

- **Organ transplantation** is the moving of an organ from one body to another or from a donor site to another location on the person's own body, to replace the recipient's damaged or absent organ.
TYPES OF DONOR

Sources
- Living donor; & self
- Cadaver/Deceased
- Animal
Living donor

• The donor remains alive and donates a **renewable tissue, cell, or fluid** (e.g., blood, skin), or donates an organ or part of an organ in which the remaining organ can **regenerate** or **take on the workload** of the rest of the organ (primarily single kidney donation, partial donation of liver, lung lobe, small bowel).

• **Regenerative medicine** one day allow for laboratory-grown organs, using person's own cells via stem cells, or healthy cells extracted from the failing organs.
Deceased donor

• Deceased donors (formerly cadaveric) are people who have been declared brain-dead and whose organs are kept viable by ventilators or other mechanical mechanisms until they can be excised for transplantation.
Classification of grafts

**Autologous grafts**
Grafts transplanted from one part of the body to another in the same individual

**Syngeneic grafts (Isografts)**
Grafts transplanted between two genetically identical individuals of the same species

**Allogeneic grafts (Allografts)**
Grafts transplanted between two genetically different individuals of the same species

**Xenogeneic grafts (Xenografts)**
Grafts transplanted between individuals of different species
What can be transplanted?

- **Organs**
  - Lungs
  - Heart
  - Liver
  - Kidneys
  - Pancreas
  - Small intestine

- **Tissues**
  - Corneas
  - Skin
  - Bone
  - Blood vessels
  - Cartilage/ligaments
Living donors

Blood
Used for transfusions and to treat diseases such as anaemia and haemophilia. Blood samples may be given for research

Liver lobes
Used for transplantation

Kidneys
Used for transplantation

Stem cells
from bone marrow or circulating blood (also from cord blood).
Used for treatment of blood disorders such as leukaemia and thalassaemia

Eggs and sperm
Used for infertility treatment and for research. Embryos created after IVF may also be donated for fertility treatment or research, or as a source of embryonic stem cells

Deceased donors

Brain
Used for research into diseases such as Alzheimer’s and Parkinson’s disease

Tissue, including corneas, skin, bone
Used for treatment (for example to restore sight, treat burns and in surgery) and in research

Organs, including heart, lungs, liver, pancreas and small bowel
Used for transplantation, or for research if not suitable for transplantation

Kidneys
Used for transplantation, or for research if not suitable for transplantation

Organs including the large bowel, bladder and prostate
Used only for research
Blood transfusion

Group 0 can donate red blood cells to anybody. It's the universal donor.

Group A can donate red blood cells to A's and AB's.

Group B can donate red blood cells to B's and AB's.

Group AB can donate to other AB's, but can receive from all others.
**Autologous graft** e.g., skin, artery, vein transplants
Allograft/Isograft organ transplant
Heart Transplant

Domino transplants - Heart and Lung
Liver transplant

Split transplants
Bone marrow transplant

Donor bone marrow cells repopulate recipient bone marrow.

Recipient
- Anticancer drug
- Radiation

Healthy donor
- Healthy bone marrow cells injected
- Healthy bone marrow cells removed

Recipient

Allogeneic bone marrow transplant
Hematopoietic stem cell transplantation

• Hematopoietic stem cell transplantation (HSCT) is the transplantation of multipotent hematopoietic stem cells, usually derived from bone marrow, peripheral blood, or umbilical cord blood.

• It may be autologous (the patient's own stem cells are used) or allogeneic (the stem cells come from a donor).
Pancreatic Islet cells transplant
Face Transplant
Hand Transplant
History of transplantation

- The legend of the “Miracle of the Black Leg” describes two surgeon brothers, who lived during the 3rd century in Asia Minor.

- The legend relates their miraculous removal of the diseased leg of a Caucasian Roman named Justinian and its replacement with the leg of a recently deceased black African.

The Miracle of Cosmas & Damian (15th c.)
• Indian surgeon Sushruta in the 2nd century BC, who used autografted skin transplantation in nose reconstruction, a rhinoplasty.

• 1823: First skin autograft-transplantation of skin tissue from one location on an individual's body to another location (Germany) In 1823 Carl Bunger, a German surgeon documents the first modern successful skin graft on a person. Bunger was repairing a person with a nose also destroyed by syphilis. He grafted a small chunk of full thickness flesh from the inner thigh to the nose successfully, in a method very reminiscent of Sushrutha’s.
• 1905: First successful cornea transplant by Eduard Zirm (Czech Republic)
• 1908: First skin allograft-transplantation of skin from a donor to a recipient (Switzerland)
• 1933: First successful cadaveric AB-0 incompatible kidney transplant (donor was B(III) and the recipient has O(I)) by Yuriu Yu. Voronoy (USSR)
• 1950: First successful kidney transplant by Dr. Richard H. Lawler (Chicago, U.S.A.)[94]
• 1954: First living related kidney transplant (identical twins) (U.S.A.)[95]
• 1955: First heart valve allograft into descending aorta (Canada)
• 1962: First kidney transplant from a deceased donor (U.S.A.)
Alexis Carrel, whose pioneering work on blood vessel suturing and organ transplantation was recognized by the 1912 Nobel Prize.
Joseph Murray and his team performing the first successful kidney transplant in 1954 using as a donor the recipient’s identical twin.


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• 1965: Australia's first successful (living) kidney transplant (Queen Elizabeth Hospital, SA, Australia)
• 1966: First successful pancreas transplant by Richard Lillehei and William Kelly (Minnesota, U.S.A.)
• 1967: First successful liver transplant by Thomas Starzl (Denver, U.S.A.)
• 1967: First successful heart transplant by Christian Barnard (Cape Town, South Africa)
• 1981: First successful heart/lung transplant by Bruce Reitz (Stanford, U.S.A.)
Reconstruction of Dr Barnard's first human heart transplantation in December 1967. Continuous need to count the sterile towels used at surgery. Cape Town.
• 1983: First successful lung lobe transplant by Joel Cooper at the Toronto General Hospital (Toronto, Canada)
• 1984: First successful double organ transplant by Thomas Starzl and Henry T. Bahnson (Pittsburgh, U.S.A.)
• 1986: First successful double-lung transplant (Ann Harrison) by Joel Cooper at the Toronto General Hospital (Toronto, Canada)
• 1995: First successful laparoscopic live-donor nephrectomy by Lloyd Ratner and Louis Kavoussi (Baltimore, U.S.A.)
• 1997: First successful allogeneic vascularized transplantation of a fresh and perfused human knee joint by Gunther O. Hofmann
• 1997: Illinois' first living donor kidney-pancreas transplant and first robotic living donor pancreatectomy in the U.S.A. University of Illinois Medical Center
• 1998: First successful live-donor partial pancreas transplant by David Sutherland (Minnesota, U.S.A.)
• 1998: First successful hand transplant by Dr. Jean-Michel Dubernard (Lyon, France)
• 1998: United States' first adult-to-adult living donor liver transplant University of Illinois Medical Center
• 1999: First successful tissue engineered bladder transplanted by Anthony Atala (Boston Children's Hospital, U.S.A.)
• 2000: First robotic donor nephrectomy for a living-donor kidney transplant in the world University of Illinois Medical Center
• 2004: First liver and small bowel transplants from same living donor into same recipient in the world University of Illinois Medical Center
• 2005: First successful ovarian transplant by Dr. P. N. Mhatre (Wadia Hospital, Mumbai, India)
• 2005: First successful partial face transplant (France)
• 2005: First robotic hepatectomy in the United States University of Illinois Medical Center
• 2006: Illinois' first paired donation for ABO incompatible kidney transplant University of Illinois Medical Center
• 2006: First jaw transplant to combine donor jaw with bone marrow from the patient, by Eric M. Genden (Mount Sinai Hospital, New York City, U.S.A.)
• 2006: First successful human penis transplant (later reversed after 15 days due to 44-year-old recipient's wife's psychological rejection) (Guangzhou, China)[96][97]
• 2008: First successful complete full double arm transplant by Edgar Biemer, Christoph Höhnke and Manfred Stangl (Technical University of Munich, Germany)
• 2008: First baby born from transplanted ovary. The transplant was carried out by Dr Sherman Silber at the Infertility Centre of St Louis in Missouri. The donor is her twin sister.[98]
• 2008: First transplant of a human windpipe using a patient's own stem cells, by Paolo Macchiarini (Barcelona, Spain)
• 2008: First successful transplantation of near total area (80%) of face, (including palate, nose, cheeks, and eyelid) by Maria Siemionow (Cleveland Clinic, U.S.A.)
• 2009: Worlds' first robotic kidney transplant in an obese patient University of Illinois Medical Center
• 2010: First full facial transplant by Dr. Joan Pere Barret and team (Hospital Universitari Vall d'Hebron on 26 July 2010, in Barcelona, Spain)
• 2011: First double leg transplant by Dr. Cavadas and team (Valencia's Hospital, La Fe, Spain)
• 2012: First Robotic Alloparathyroid transplant. University of Illinois Chicago
• 2013: First successful entire face transplantation as an urgent life-saving surgery at Maria Skłodowska-Curie Institute of Oncology branch in Gliwice, Poland.[99]
• 2014: First successful uterine transplant resulting in live birth (Sweden)
• 2014: First successful penis transplant. (South Africa) [100]
• 2014: First neonatal organ transplant. (U.K.) [101]
HAMBONE by Mike Flanagan

HOW MUCH FOR A BRAIN TRANSPLANT?

$10,000 FOR A MALE BRAIN, $5,000 FOR A FEMALE BRAIN

WHY IS THE MALE BRAIN SO MUCH MORE?

IT'S HARDLY BEEN USED!
Organ Transport