The ESRF Research Journal for Undergraduate Medical Students

Medical History

Volume 3 Issue 1 (Jul-Dec) 2025

DOI: 10.5281/zenodo.17346021

Kidney Transplantation

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Available from: https://esrfrjums.co.in/index.php/main/article/view/78

Published by: Eureka Scientech Research Foundation, Kolkata.

Online access: https://esrfrjums.co.in

Organ and tissue transplantation has long been an idea in many cultures' myths and tales, before becoming a medical reality in the mid-twentieth century. These myths reflect an age-old interest with the prospect of restoring health or even granting magical abilities by exchanging body parts. However, the practice of transplantation began in early twentieth century. Emerich Ullmann, an Austrian doctor, reported the first attempted kidney transplant in 1902, when he performed an auto-transplant in a dog by removing the kidney from its original position and transplanting it in the neck by anastomosing it to the neck vessels. This procedure successfully produced urine for a short time before the dog died.

Mathieu Jaboulay was a French surgeon, who is remembered for introduction of new surgical procedures, as well as his work involving techniques of vascular anastomosis. He studied and practiced medicine in Lyon, where he was appointed professor of clinical surgery in 1902. Two of his most well-known students in Lyon were Alexis Carrel and René Leriche.

In 1906, Jaboulay performed the first clinical kidney xenotransplant, that resulted in some urine output. He believed that using animal organs to induce urine production could aid in the treatment of persons suffering from renal failure. The first transplant was performed on 24th January 1906 in a 48 -year-old lady with oliguria and other symptoms. A pig was chosen as the organ's source. After excision of the left kidney, it was immediately immersed in a warm artificial serum. Following the dissection of the veins in the fold of the patient's elbow, the pig kidney was grafted into the left antecubital region and left exposed. The renal artery was connected to the humeral artery's central end, while the renal vein was linked to the median cephalic vein's central end. The arterial blood flow was observed through the humeral artery into the renal artery. After the closure and dressing of the operative site, the kidney produced around 1500 ml of urine. On the third day, Jaboulay saw that the kidney was no longer functional; it was removed that same day. Following inspection, Jaboulay determined that the cause of the failure was vascular thrombosis.

Three months later on the 9th of April 1906, Jaboulay tried his second xenotransplant, and this time using goat's kidney. A 50-year-old woman with renal insufficiency underwent a left-sided goat kidney graft to her elbow fold. Despite an uneventful procedure, the same outcome was observed, and the goat kidney had to be removed on the third day, just like the previous one.

Alexis Carrel, a French surgeon and biologist, was born in 1873 in Sainte-Foy-lès-Lyon. He was the eldest son of textile manufacturer Alexis Carrel-Billiard. After the death of his father, his mother undertook embroidering work and Alexis was very keen in learning these. He received his Doctor of Medicine degree from famous University of Lyon in Europe. Alexis Carrels' desire to improve anastomosis of vessels led him to visit Lyons' finest embroiderist, Madame Leroidier, to learn how to utilize the tiny needles and thread used in delicate stitching. Carrel's goal for vascular anastomosis was to eliminate stenosis, haemorrhage, or thrombosis. In 1902, he published his first manuscript on vascular anastomosis in French literature. In 1912, he received the Nobel Prize for his pioneering work on triangulation technique of vascular anastomosis which paved the path for organ transplantation.

Yurii Voronoy (1895-1961), a Ukrainian surgeon from the Kharkov Medical Institute in Kherson, in the former USSR, is a pioneer in the history of clinical transplantation. He performed the first human kidney transplantation. Previously, he had performed kidney transplants on dogs. In 1933, he transplanted a human kidney from a cadaveric donor (blood group B), who died as a result of a serious head injury, to a 26-year-old girl with blood group O, who had acute renal failure after consuming mercuric chloride in an attempted suicide. The donor nephrectomy was performed roughly six hours

after death and transplanted to the recipient's thigh under local anaesthetics. Though the patient improved on the first postoperative day, the kidney never functioned properly, and she died on the second day.

Between 1940 and 1950, the initial attempts of transplantation were mostly unsuccessful due to rejection and lack of immunosuppression. In 1947, Karl Landsteiner, Hufnagel, and David Hume described a one-of-a-kind transplant case in Boston's Peter Bent Brigham Hospital. The patient eventually restored native kidney function, and the graft was removed after normal renal function was established. Following that, Simonsen from Denmark and Dempster from London separately discovered that transplanting the kidney to the pelvis position was preferable to a superficial site.

Richard Lawler, a surgeon from Chicago, performed the first successful kidney allograft transplant at Mary Hospital in Illinois in 1950 on Ms Ruth Tucker using a kidney from a deceased donor. She was a 44-year-old woman with polycystic kidney disease. Both of Tucker's kidneys had been affected. Her mother and sister both died from the same disease. Kidney transplant was her only option for survival because dialysis was not available widely at that time. Unfortunately, Tucker's body rejected the new kidney. It was removed 10 months after the surgery. However, the transplant was not in vain. The new kidney worked for more than sixty days and helped Tucker's remaining kidney regain normal function, letting her to live another five years. In 1955, she died of coronary artery disease unrelated to the kidney disease.

In 1952, nephrologist Jean Hamburger and his surgical team performed the first live-related kidney transplant in Paris, placing the graft kidney in the pelvic position. A mother gave her kidney to her son, who had destroyed his solitary kidney due to a fall from height. The kidney initially functioned normally, but on the 22nd day, acute rejection occurred.

Joseph Edward Murray (April 1, 1919 – November 26, 2012) was an American plastic surgeon and was known as the "father of transplantation". In Boston, on December 23, 1954, Joseph Murray, J. Hartwell Harrison, and John P. Merrill performed the first successful kidney transplant from one identical twin (Ronald Herrick) to the other with renal failure (Richard Herrick) at Brigham Hospital. To lessen the possibility of rejection, the doctors confirmed that the two were identical twins. Richard Herrick's transplant was successful, and he lived a normal life for eight years before dying from some unrelated causes. This event has encouraged many such transplantations around the world. Joseph Murray was awarded the Nobel Prize in Physiology or Medicine in 1990 for his achievements.

Charles Rob and William James Dempster performed the first deceased donor transplant in London in 1955, but it was not successful. The concept of "brain death" was introduced few years later by Guy Alexandre, a Belgian surgeon. In 1959, in his work coma depasse, he stated that by continuing artificial ventilation allowing oxygenation to organs in patients with no brain function, could preserve them for transplantation.

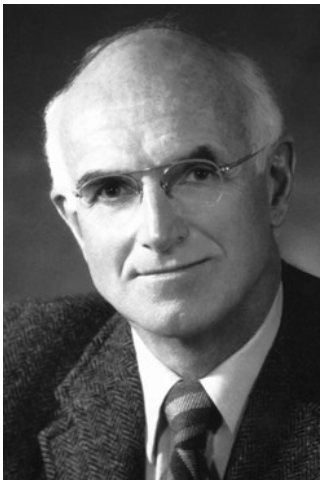
Later, the use of modern laboratory facilities and introduction of new drugs paved the way for successful kidney transplants worldwide. The discovery of human leukocyte antigen (HLA) in 1958 by Jean Dausset is a major breakthrough in immunological research. Later on, HLA-DR matching was justified, with particular emphasis on performing transplants where two DR antigens are shared between donor and recipient. Immunosuppressants have played a great role in this regard. Introduction of azathioprine and corticosteroids, was found to be a great milestone in non-twin kidney transplants. By 1970, many transplant centres were set up worldwide. In the 1970s Jean-François Borel (1933 – 2025), a Belgian microbiologist and immunologist, discovered Cyclosporine, a strong immunosuppressive drug. Cyclosporine became the most often used immunosuppressive drug until the 1990s. Tacrolimus was originally utilized by Starzl et al in 1989, when they realized it had more potential than Cyclosporine, and it has since superseded Cyclosporine. Mycophenolate, discovered much earlier in the twentieth century, was also used for kidney transplants and proved to be an incredibly beneficial medicine. Introduction of tacrolimus, mycophenolate mofetil, sirolimus, monoclonal antibodies (OKT3, basiliximab etc.) improved long-term outcomes in transplant recipients. Minimally invasive donor nephrectomy (laparoscopic and robotic surgery) improved living donation rates.

In India, the kidney transplant has kept pace with the rest of the world. In 1950, at the King Edward Memorial (KEM) Hospital in Mumbai, India, the first animal kidney transplant was tried. In May 1965, KEM Hospital performed India's first human kidney transplant, transferring a cadaveric donor kidney to a patient with hypernephroma. The graft performed well, but the patient died within ten days owing to a sudden myocardial infarction. On 2nd February, 1971, Mohan Rao and Kaivilayil V Johny performed the country's first successful living donor kidney transplant at Christian Medical College (CMC) in Vellore. In 1972, successful renal transplant was performed at the All India Institute of Medical Sciences, New Delhi.

Kidney transplantation is now the treatment of choice for end-stage renal disease (ESRD) and offers better survival and quality of life compared to dialysis. Today, kidney transplantation is an advanced, routine, and life-saving therapy for such patients.

Alexis Carrel was awarded Nobel Prize in 1912 "in recognition of his work on vascular suture and the transplantation of blood vessels and organs".

Image Courtesy: https://www.nobelprize.org/prizes/medicine/1912/summary



Joseph E. Murray was awarded Nobel Prize in 1990 "for their discoveries concerning organ and cell transplantation in the treatment of human disease".

Picture Courtesy: https://www.nobelprize.org/prizes/medicine/1990/murray/facts/

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