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How has the development of Organ Transplants contributed to Medicinal Practices today?

Humanity has progressed extraordinarily in the last 100 years; not just in terms of technology, but also in terms of medicine. Organ transplants are something very regular and common in medicinal practices today. The idea of replacing diseased or damaged body parts has been around for millennia, but the first successful organ transplant was carried out in 1954, following numerous failed attempts. This has massively changed modern medicine – so much so that, today, a world without organ transplants is unimaginable. Many other discoveries were also made on the way, making immense contributions to medicine as we know it today.

Firstly, the research leading up to successful organ transplants has resulted in the establishment of transplantation immunology, as well as other basic principles of immunology. The first application of organ transplantation is known to have been in 600 B.C. when autogenous skin flaps were used to replace missing noses. By the 16th century, these procedures had become quite successful at the hands of Gaspare Tagliacozzi (1597) and several other plastic surgeons of the era. Tagliacozzi invented the innovative surgical technique which involved reconstructing faces using grafting. This involved freeing the patient's own tissue (autografts) or that of other donors (homografts) to repair damaged organs. It didn't come to anyone's attention that the transplants of homografts may fail. The conclusion that the effectiveness of homografts and autografts differs was reached in the last half of the 20th century. It was only reported once that homografts were less effective in this era, but this report was ignored and overseen by the numerous misleading claims of successful homografts. An example of a false claim is when Winston Churchill donated skin to an officer to help heal a wound. Years later, Churchill reported that the graft was still successful. In 1903, biologist Carl Jensen theorised that there was an immune reaction preventing homograft transplantation from being successful, but this was discounted as no antibody could be detected and, at the time, an antibody was the only hallmark of immunity; therefore its absence meant that this could not be the case. In the first decades of the 20th century, investigators established the inevitability of homograft transplantation rejection and most of the basic principles of immunology, owing to studies carried out by Peter Medawar, later, in 1958.

Secondly, research into homograft transplants has led to the discovery of organ transplant rejection. Many immunologists and biologists studied this phenomenon in great detail for many years. Biologist James B. Murphy's work in 1914 led to the conclusion that transplantation immunology was largely due to the lymphocyte. He showed that resistance to tumour homografts was due to the lymphoid system, but he could not explain why. However, his findings were largely ignored and forgotten. Furthermore, biologist Leo Loeb's studies on rats found that the strength and timing of rejection depended on the extent of genetic disparity between the donor and recipient. He also showed that the lymphocyte was involved. However, a dispute between him and other researchers in the university tarnished his reputation and his contributions were also forgotten. Many attempts at organ transplantations took place and failed all around the world. Then, biologist Peter Medawar joined surgeon Thomas Gibson to explore the use of skin homografts for treating burned pilots. They concluded that homografts always failed, being unaware of Murphy and Loeb's findings. After several immunology studies, Medawar, along with his associates, found that homograft transplantation, where the donor and recipient were twins, were successful. It was concluded that failed homograft transplantation was due to antigens found on the donor's tissue which differed from those of the recipient. It also depended heavily on the lymph system. This is what is known as 'organ

transplantation rejection' today. This research is what led Medawar to be considered as the main figure in the development of organ transplantation.

Furthermore, the development of organ transplantation led to the discovery of the HLA antigen (and thus, tissue typing) and immunosuppressants. Organ transplant rejection involves the recipient's immune system attacking the donated organ due to the differences in antigens. This triggers a transplant reaction, where the immune system attacks the tissue, which then leads to death. In 1954, the first successful organ transplant took place. It was a kidney transplant carried out by Dr Joseph E. Murray in Brigham and Women's Hospital in Boston, MA, USA. In the late 1960s, liver, heart and pancreas transplants had been performed successfully, while successful lung and intestinal transplants began in the 1980s. The first kidney transplant was between twins, which decreased the possibility of an immune reaction. This was years before doctors discovered how to trick the immune system. To solve the problem of organ transplant rejection, the concept of tissue typing was invented, which involves matching the donor's antigens as closely as possible to those of the recipient. Jean Dausset discovered the human leukocyte antigen (also known as HLA) before this in 1958, which is what made tissue typing possible. Furthermore, immunosuppressants were also developed for this cause. These are drugs used to stop the rejection of organs that are transplanted in patients. Steroids (GC) were developed very early on in the history of transplantation and are still used today. Azathioprine was discovered in the 1960s due to the experiments carried out by Sir Roy Calne, which hugely contributed to the world of transplantation as well. Many other immunosuppressants were developed in the decades to come, further facilitating organ transplants over the years.

In modern medicinal practices, organ transplants take place daily, largely owing to the research carried out by Peter Medawar and many other researchers. In 2019, 39,718 organ transplants were performed in the USA alone. Many complicated transplants can be successfully performed now, like heart valve and middle ear transplants. These transplants can help recipients live longer and healthier lives. Successful organ transplants involve using tissue typing to match recipients to donors. The match cannot be perfect as it is only possible for twins to have the exact same antigens but the closer the match, the less of a reaction will result. It is also important that the patient completes their course of immunosuppressants to control the immune system's reactions. Additionally, immunosuppressants are also used to treat autoimmune diseases like psoriasis and lupus, in which the body's own immune system attacks its tissue. Therefore, both tissue typing and immunosuppressants have hugely contributed to medicine today.

In conclusion, the development of organ transplantation has not only led to successful organ transplants, which help patients live longer and healthier lives, but also to multiple other developments and discoveries which play a huge role in medicinal practices today. These include the basics of immunology, transplantation immunology and organ rejection, the HLA antigen, the development of the tissue typing technique and immunosuppressants. Most of these discoveries took place in the last century, exhibiting how rapidly medicine has progressed during this time. Therefore, it is highly justified to claim that the discovery and development of organ transplantation have heavily influenced modern medicine today.