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History, Outcomes, Clinical Challenges, and Opportunities: Clinical Transplantation

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Abstract

Clinical transplantation, also known as organ transplantation, is the process of removing an organ from one person, the donor, and transplanting it into another person, the recipient. The goal of clinical transplantation is to improve the health and quality of life of individuals who have organ failure or disease. In this mini-review, we will discuss the history of clinical transplantation, the types of transplants, the transplantation process, and the challenges of clinical transplantation.

Keywords: Transplantation; Autologous transplantation; Allogeneic Transplantation; Cancer cells

History of Clinical Transplantation

The first successful human kidney transplant was performed in 1954 by Dr. Joseph Murray and his team at Brigham and Women's Hospital in Boston. Since then, clinical transplantation has become a standard treatment for end-stage organ failure or disease. In addition to kidneys, other organs that can be transplanted include the liver, heart, lungs, pancreas, and small intestine. Tissue transplants, such as corneas and skin, are also common [1].

Types of Transplants

There are two types of transplants: autologous and allogeneic. Autologous transplantation involves transplanting an individual's own cells or tissues back into their body after being treated and expanded outside of the body [2]. This type of transplant is often used in bone marrow transplants for cancer treatment. Allogeneic transplantation involves transplanting cells or tissues from another person, usually a close relative or an unrelated donor [Figure 1] [3].

Autologous Transplantation

Autologous transplantation involves the transplantation of cells, tissues, or organs from one individual to another, usually from the same person. In this type of transplantation, the donor and the recipient are the same person. Autologous transplantation is commonly used in the treatment of cancer, where the patient's own cells or tissues are collected, treated or modified, and then transplanted back into the patient's body [4].

One of the most common types of autologous transplantation is bone marrow transplantation. This procedure involves the collection of bone marrow cells from the patient's body, which are then treated with chemotherapy or radiation to eliminate cancer cells [5]. The treated cells are then transplanted back into the patient's body, where they can produce healthy blood cells. Another example of autologous transplantation is the use of skin grafts to treat severe burns. In this procedure, a small amount of healthy skin is removed from an unburned area of the patient's body and transplanted to the burned area. The advantage of autologous transplantation is that there is no risk of rejection because the transplanted cells or tissues come from the patient's own body [6]. However, autologous transplantation is limited by the availability and quality of the patient's own cells or tissues.

Allogeneic Transplantation

Allogeneic transplantation involves the transplantation of cells, tissues, or organs from one individual to another, usually from a donor who is genetically different from the recipient. Allogeneic transplantation is used in the treatment of a wide range of diseases, including cancer, blood disorders, and immune system disorders.

One of the most common types of allogeneic transplantation is bone marrow transplantation. In this procedure, bone marrow cells are collected from a genetically matched donor, usually a sibling or an unrelated donor [7]. The collected cells are treated with chemotherapy or radiation to eliminate cancer cells and transplanted into the patient's body. Allogeneic transplantation carries a risk of rejection because the transplanted cells or tissues are foreign to the patient's body. To reduce the risk of rejection, patients receiving allogeneic transplantation are usually given immunosuppressive drugs.

Another example of allogeneic transplantation is the transplantation of solid organs, such as the heart, liver, kidney, and lungs. In this type of transplantation, the organs are usually obtained from a deceased donor who has previously consented to organ donation. The organs are transplanted into the recipient's body, and the patient is given immunosuppressive drugs to prevent rejection [8]. The advantage of allogeneic transplantation is that it can provide a larger pool of cells or tissues for transplantation, and it can be used to treat diseases that are not responsive to autologous transplantation. However, allogeneic transplantation carries a higher risk of rejection and complications associated with immunosuppressive drugs [9].

Transplantation Process

The transplantation process begins with the identification and evaluation of a potential donor. The donor must be medically and psychologically screened to ensure that the organ or tissue is healthy

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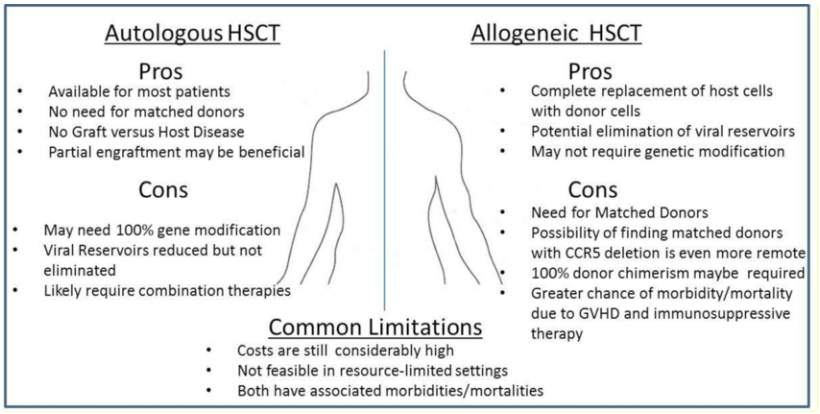

Figure 1: Two types of transplantation.

and suitable for transplantation. The recipient is also evaluated to determine the severity of their condition and whether they are a good candidate for transplantation. Once a suitable donor is identified, the organ or tissue is removed and prepared for transplantation. The recipient is prepared for the transplant surgery, which may involve medication to suppress the immune system and prevent rejection of the transplanted organ. The transplant surgery is typically performed under general anesthesia, and the recipient is closely monitored during and after the surgery for complications.

After the transplant surgery, the recipient will need to take medication to prevent rejection of the transplanted organ for the rest of their life. Regular follow-up appointments with the transplant team are necessary to monitor the function of the transplanted organ and adjust the medication regimen as needed [10].

Challenges of Clinical Transplantation

One of the biggest challenges of clinical transplantation is the shortage of donor organs. There are far more people in need of transplants than there are donors, and the waiting list for a transplant can be several years long. This has led to the development of living donor programs, where a healthy person can donate a kidney or a portion of their liver to a family member or friend in need. Another challenge of clinical transplantation is the risk of rejection of the transplanted organ. The immune system can recognize the transplanted organ as foreign and attack it, leading to organ failure [11]. Medications that suppress the immune system can reduce the risk of rejection, but they can also increase the risk of infections and other complications. Finally, the cost of clinical transplantation can be a significant barrier for some individuals. The cost of the transplant surgery, medication, and follow-up care can be tens or even hundreds of thousands of dollars. Insurance may cover some or all of the cost, but not all insurance plans cover clinical transplantation [12].

Conclusion

Clinical transplantation is a life-saving procedure for individuals with end-stage organ failure or disease. The process involves the identification and evaluation of a suitable donor, preparation of the organ or tissue for transplantation, and the transplant surgery and follow-up care for the recipient. The challenges of clinical transplantation include the shortage of donor organs, the risk of rejection of the transplanted organ, and the cost of the procedure. Nonetheless, the success of clinical transplantation has improved

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