



INDO AMERICAN JOURNAL OF PHARMACEUTICAL RESEARCH



ORGAN TRANSPLANT – A SYSTEM WITHIN ITSELF

Neha Naaz^{*}, Aaminah Najmus Sahar, Khadija Akhtar Omer, Humaira Minhaj, Sufia Iram Irshad.

Department of Pharmacy Practice, Deccan School of Pharmacy(DSOP),OU,Hyderabad500001,Telangana,India.

ARTICLE INFO

Article history

Received 05/02/2020

Available online

31/03/2020

Keywords

Solid, Organ,
Transplant, Rejection,
Live Donor, Deceased Donor,
Registered Donor,
Hyperacute Rejection.

ABSTRACT

Organ transplant seems like a complex procedure and many are unaware of the process to register as a donor. This article is to create a base for understanding the procedure of organ transplant, the personnel involved and the process to register as a donor. Organ transplant is a process in which an organ completely from one human being to the other. Different types of sources for organ transplant include Live donor, deceased donor. Not all organ transplants are successful, transplant rejection is common and it's types include Hyperacute-rejection, chronic rejection, acute cellular rejection and acute vascular rejection. The various aspects of a solid organ transplant procedure like personnel involved and how to get oneself as a donor volunteer include a sequence of steps to do. With a better understanding of the process of organ transplant and registering as a donor, many lives can be healed. More awareness about organ donation is necessary.

Corresponding author

Neha Naaz

Department of Pharmacy Practice,
Deccan School of Pharmacy (DSOP),
OU, Hyderabad -500001,
Telangana, India.
neha.naazshah@gmail.com

Please cite this article in press as **Neha Naaz et al.** Organ Transplant – A System Within Itself. *Indo American Journal of Pharmaceutical Research*.2020;10(03).

Copy right © 2020 This is an Open Access article distributed under the terms of the Indo American journal of Pharmaceutical Research, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

The process of organ transplant is a mystery to many and looks like a maze of horror to those unaware of the process, risks, consequences and complications of an organ transplant. This article focuses on easing the process of understanding Organ transplant in a simple way. The information reviewed belongs to articles of journals, textbooks and web pages which are thoroughly studied and simplified to fathom organ transplant.

A cell has the unique ability to reproduce according to its requirements under favourable conditions. It also possesses the ability to control the structure and function of the daughter cell. Stem cells are the best example to learn the supreme ability of a cell which is totipotency. The cells which align as a mass and have same function are known as tissue. There are four types of tissues, the epithelial tissue, the muscle tissue, the connective tissue and the nervous tissue. A single tissue or the combination of the four tissues improvise co-ordination and function as a single unit, an Organ. An Organ is a complex system of tissues working together to provide basic functions of the body and determines the life support. The organs work in sync with other organs to build an Organ system. For example, the skin on the human body is a longest organ and comprises of epithelial tissue and connective tissue. Its function is protection, sensation, temperature regulation, immunity, excretion and others [1]. It works in co-ordination with various other organs to bring about these functions.

The complexity of the organs structure and function makes them vulnerable to various kinds of damage. Organ damage could be reversible or irreversible depending on the type, duration and severity of the insult which occurs. The human body usually regenerates the damaged part of the organ in case of reversible organ damage except the nervous tissue.

In case of irreversible damage tissue necrosis occurs and leads to death of a part of the organ. This deceased part is generally removed by excision[1]. In case of complete damage to the organ or loss of function of the organ due to irreversible damage, the body functions deteriorate in terms of the organ system involved. This leads to disturbed body functions and the symptoms generally characterize over a period of time. In some cases, the body fails to compensate for the damaged organ and it can lead to fatalities.

Organ failure is one of the most severe complications a human body deals with and the best option is Organ transplantation. Serious organ damage can also be treated with organ transplantation which provides the most promising treatment of end stage organ failure.

Transplantation is the process of transferring a healthy tissue or an organ completely from one human being to the other or from one part of human body to the other part of the same.

The term “organ transplant” usually refers to transplants of the solid organs: heart, lungs, liver, kidneys, pancreas and intestines. Different varieties of transplants that are less invasive or might need specialised procedures include: Skin transplants or grafts, membrane transplants (Cornea) and bone marrow transplants. These type of transplants are called as “Grafts.”

Transplantation from another human body involves the risk of rejection which is now brought to a minimal of occurrence due to the improvement of immunosuppressants with less severe ADRs. The various types of transplants vary in their attributes to success of the organ replacement, complications and rejection.

Types of Transplant:

Transplant is broadly classified on the basis of source of the donor organ.

Autograft/ Auto-transplantation:

In an Autograft the transfer of healthy tissue from one site of the body to another which requires healthy tissue for survival. The donor and the recipient are the same individual. This type of transplant does not show rejection as the genetic composition of donor tissue is not different from the recipient.

Syn-graft:

Syn-grafting is the transfer of healthy tissue or solid organ between two individuals with identical genetics. The recipient and donor have high compatibility genetically and generally are immediate family or relative or monozygotic twins. These transplants have very less chances of rejection unless there is any compromise in the surgical intervention.

Allograft:

The Allograft technique is the transfer of organs from an individual who is not related to the recipient. The donor and recipient have good compatibility and the chances of rejection are slightly higher due to the non-relativity of the two. However, the development of lifetime immunosuppressants have made the Allografts easier and dominant.

Xenograft:

This is the type of transplant with a high risk of complications pertinent to the origin of the donor tissue or organ from a different species i.e., non-human species. The genetic make-up of donor and recipient is vaguely different yet there are few tissues which provide moderate health to the recipient when transplanted. Different species are now used for the extraction of healthy tissues. Eg: Use of Porcine islet cells of Langerhans in patients with Type-1 Diabetes mellitus.

Autograft, Syngraft and Allograft are under the category of “Homograft” as the donor and recipient belong to the same species. However, Xenograft is a type of “Heterograft” as the donor is of a different species from the recipient.

In the process of transplant, the donor plays a very important role. The health of the donor and the condition of donor organ is essential. The various categories of donors can be summarized as:

Living Donor:

A healthy individual who voluntarily donates a part of their healthy organ (Eg: Liver) or in a few cases a solid organ (eg: kidney) comes under this category. This type of transplant serves well and the waiting process of replacing the compromised organ shortens. The recovery time of the recipient is also short when the organ is replaced before the worsening of end-stage.

Deceased Donor:

The Deceased donation is donating one's organs just before or at the time of death. Many individuals across the globe register as donors before their death. The process of registering as a donor and allowing organ recovery after death has saved many lives.

Vascularized Composite Allografts:

In this type of donation, the healthy tissue of a living donor like tendons, skin, bone marrow is transplanted to recipient. Eg: Tissue donation, cornea donation.

Transplantation Process involves a recipient, a donor, various healthcare professionals and other active personnel who ease the phenomenon.

Members involved and their role in Transplantation**Transplant co-ordinator:**

- He is a member who is responsible for:
- The coordination of care of organ transplant patients
- Hiring donors
- Co-ordinates medical, surgical, financial, psychological, nutritional and pharmaceutical evaluation and ongoing care needs of transplants and living donor patients.
- Must be able to provide age specific care and intervention
- Provides accurate and timely documentation of care.

Transplant Surgeon

It's his job to transplant or move organs from 1 human to another so that recipient can live a longer, healthier life. Without vital organ transplants, patients can die even at young ages. The duties of a transplant surgeon involve:

- Assess the patients before the surgery
- Perform the surgery
- Post-operative care until discharge
- Assess risk and benefits of surgery
- Co-ordinate with the other physicians, nurses, social workers and other professionals
- Transplant Physician:
- The one who monitors all non-surgical aspects of patient care
- Adjusts the medications after surgery
- Monitors the kidney function to identify any problem including rejection of donated kidneys
- Manage other co-morbidities such as Diabetes, HTN

Transplant Unit-staff members:

- Their role is to monitor and evaluate the patient everyday
- Assist with documentation
- Carryout plans of attending Transplant Surgeon and Physician
- They play an integral role during the patient's time in hospital

Financial Planner:

- Helps to plan the cost of Transplant
- Estimates the total cost
- Provides information on insurance coverage and financial resources

Social Worker:

- Helps the patients and families and cope with the kidney transplant and illness.
- They link to community services, therapist and other supports
- Check in on Patient and family
- In some cases, handle the duties of financial co-ordinator

Dietician:

- Is a licensed registered clinician with special training in nutrition.
- Creates a diet plan to help recover quickly, stay healthy and avoid gaining too much weight after surgery and managing diet after transplantation

Procedure for donation or transplantation:**Registering as a donor**

- Medical care of potential donor
- Brain death test
- Organ procurement organization
- Authorizing donation
- Matching process
- Recovery and transporting organs
- Transplanting the organs

Identification of Potential donor by Hospital:

- Evaluation of donor eligibility
- Authorization of donor eligibility
- Medical maintenance of patient
- Matching organs to potential recipients
- Offering organs regionally rather than nationally
- Harvesting the organ- distribution of organs- follow up with family
- Care of organ until transplanted
- Preparing the recipient for surgery
- Distribution of organs
- Post-operative recovery monitoring

The process of transplantation has been successfully performed in case of organs like heart, lungs, kidneys, liver, intestine, pancreas etc.

Liver Transplantation:

Liver transplantation is successful in decompensated alcoholic liver disease patients and has provided them with better quality of life for almost the next decade of their life. Recurrence of disease is a chance but with fairer odds[2]. Liver transplantation is the best option of treatment in cases of Hepato-renal Syndrome, End stage Liver cirrhosis, End stage PBC, End stage PSC or any End stage liver disease[3]. The vitality of a healthy liver provides better healing of the body and instant symptomatic relief. The quality of life is improved and survival rates of the patient drastically changes[2].

Kidney Transplantation:

The kidneys are involved in removing the waste products, excess fluids and drugs from the body ,balance the body fluids, release hormones, produce active form of vitamin D and control the production of red blood cells [2] . End stage kidney disease, also known as stage 5 kidney disease is characterized by permanent kidney failure. Dialysis or kidney transplantation are the two mandatory options at this stage [3].

Successful transplantation of kidney provides the best possible quality of life for patients with end stage renal disease. The rates of transplantation in the developing world are comparatively lower than in the developed world [4]. In India, the kidney transplantation programme has evolved in the last 45 years and presently is the second largest programme after USA in numbers. It is estimated that the prevalence of end stage renal disease which requires kidney transplantation in India is between 151and 232 per million population [5]. The rate of complications associated with kidney transplant is low when compared to other transplants like pancreas and liver transplant. Either a wound or one of the three anastomoses (renal artery, renal vein, ureter) can be involved in surgical complications [6].

Heart Transplantation:

Heart transplant is a complicated procedure and the criteria for heart transplant is co-dependent with other organs. For example, Liver cirrhosis has generally been considered a contraindication to heart transplantation. A 50% in hospital mortality rate was reported in the few cases of heart transplantation performed in patients with liver cirrhosis. And highest mortality was in patients with a cardiac diagnosis other than cardiomyopathy and in those with a previous sternotomy and massive ascites. Combined heart and liver transplantations are feasible in carefully selected patients in expert centres. The heart conditions which require a heart transplant include Advanced heart failure in which maximum alternative treatment options are exhausted and proved to be failure.[4] The eligibility for a heart transplantation is assessed by the review board of the particular Hospital or institution where multiple confounding factors like duration of heart disease, exhaustion of alternative treatment options, age, post-surgical recovery and many other factors are reviewed[5]. The benefits of a new heart come with many potential risks of Organ rejection, bleeding, infections, stroke, embolism, myocardial infarction and death. [4]

Lung Transplantation:

The major function of the lungs is to get air in close contact with blood such that oxygen can diffuse into and carbondioxide out of the blood. Other non-respiratory functions of lung are to clear the particles from airways, inactivating the polypeptides, prostaglandins, etc [7].

Lung transplantation is an accepted treatment option for patients with various types of advanced, progressive, chronic lung disease those who do not respond to non-transplant therapies. In patients with end stage lung disease, lung transplantation can improve the quality of life and prolong the survival of individuals. Challenges that must be overcome to improve the post-transplant survival includes successful bridging patients to transplant, expanding the lung donor pool, inducing tolerance, and preventing a myriad of post-transplant complications like primary graft dysfunction, forms of cellular and antibody-mediated rejection, chronic lung allograft dysfunction, and infections [8].

55 years ago, James Hardy in 1963 has made the first attempt of lung transplantation in humans. There were lot of problems due to rejection and anastomotic site healing. With the introduction of Cyclosporine and advanced surgical techniques, the rejection rates have been improved. Now, the survival post lung transplant is 80% at 1 year, 65% at 3 years, and 54% at 5 years [9].

Post transplantation is often marked by complications that affects both the quality and duration of the recipient's life. These can include infections by Cyto-megalovirus, Aspergillus, Neoplastic complications like Post-transplant lymphoproliferative disease, Lung cancer, Osteoporosis, Gastrointestinal complications, Neurological complications like leukoencephalopathy, stroke, Hyperammonaemia, Renal complications like Haemolytic uraemic syndrome, Calcineurin-inhibitor nephrotoxicity [10].

However, in few cases the transplanted organs are rejected due to various reasons. The immune system of the recipient identifies the freshly transplanted organ as a foreign entity and attacks it. The various types of Transplant rejections and their mechanisms are as follows:

Hyper acute:

This occurs within minutes of transplant and is a rare phenomenon. It may result in rapid and permanent damage to the organ being transplanted. It is supposedly due to the action of antibodies against the donor HLA antigens existing prior to transplant.

Acute cellular:

It is the most common rejection of organ due to T cell mediated immunity resulting in compromising the transplant organ's integrity physically and functionally.

Acute Vascular:

It occurs at the beginning of transplant and is a slower process in contrast to hyperacute rejection as the mode of rejection is stimulation of complement cascade. The immunosuppressive therapy prior to the transplant plays a major role in the moderation of rejection. It may or may not damage the organ.

Chronic:

The mechanism of rejection is not well understood but the rejection presents as scarring of transplant, Fibrosis etc. Other responsible factors could be presence of comorbidities, prolonged or misuse of drugs leading to toxicity.

CONCLUSION

The different roles of donor as live donor or a deceased donor are also explained. The procedure to get registered as a donor is simple and takes few simple steps. A better understanding of solid organ transplant can encourage more volunteers to be organ donors and improve the quality of health in our society. As the technology increases its spectrum day by day, we can expect improved techniques for solid organ transplant or replace solid organ transplant with better techniques in the future. Until then we have to make people aware of the phenomenon of organ transplant so they can understand better and help better.

ACKNOWLEDGEMENTS

I would like to thank Prof. DR. Osman Ahmed for his extra-ordinary support in guiding me.

Conflict of interest:

There is no conflict of interest

Ethical matter:

No animals or humans were harmed in reviewing this article.

ABBREVIATIONS:

ADR: Adverse Drug Reaction 3
 HLA: human leukocyte antigen 7
 HTN: Hypertension 4
 PBC: Primary biliary cirrhosis 5
 PSC: Primary sclerosing cholangitis 5

REFERENCES

1. IvyRose, "Ivyrose Holistics," IvyRose Ltd. , [Online]. Available: <https://www.ivyroses.com/HumanBody/Skin/Functions-of-the-Skin.php>. [Accessed 5 May 2019].
2. J. T. dipiro, Pharmacotherapy: A Pathophysiologic approach, Japypee medical, 2015.
3. P. a. E. S. C. P. Gilbert L. Queeley, "Comparing Treatment Modalities for End-Stage Renal Disease: A Meta-Analysis," *Am health drug benefits*, vol. 11, no. 3, pp. 118-127, 2018.
4. A. K. NP Singh, "Kidney transplantation in India: Challenges and future recommendation," *MAMC Journal of Medical sciences*, vol. 2, no. 1, pp. 12-17, 2016.
5. S. Shroff, "Current trends in kidney transplantation in India," *Indian journal of Urology*, vol. 3, no. 32, pp. 173-174, 2016.
6. A. H. e. al, "Surgical Complications After Kidney Transplantation," *US National Library of Medicine*, vol. 18, no. 6, pp. 505-510, 2005.
7. D. W. Empey, "Diseases of respiratory system ,structure and function of lungs," *British medical journal*, vol. 1, pp. 631-633, 1978.
8. K. C. Meyer, "Recent advances in lung transplantation," F1000 Research, Madison,WI,USA, 2018.
9. T Sunder, T Paul Ramesh, K Madhan Kumar, M Suresh, Sarvesh P Singh, S Seth, "Lung transplant: The Indian experience and suggested guidelines – Part 1 selection of the donor and recipient," *Journal of the practice of Cardiovascular sciences*, vol. 4, no. 2, pp. 88-95, 2018.
10. V. A. R.M. Kotloff, "Medical complications of lung transplantation," *European Respiratory Journal*, vol. 23, pp. 334-342, 2004.



54878478451200203



Submit your next manuscript to **IAJPR** and take advantage of:

Convenient online manuscript submission

Access Online first

Double blind peer review policy

International recognition

No space constraints or color figure charges

Immediate publication on acceptance

Inclusion in **ScopeMed** and other full-text repositories

Redistributing your research freely

Submit your manuscript at: editorinchief@iajpr.com

