Review Article

Need, process and importance of organ transplantation

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Abstract

Organ transplantation is a medical procedure in which an organ is removed from one body and replaced in the body of a patient who has damaged or missing organs. The person who donates organ is called donor whereas a patient who receives it, is called the recipient. The donor and recipient may be available in the same location, or organs may be transferred from a donor site to the recipient site by a suitable method. Successful transplanted organs to date include the lungs, intestine, uterus, heart, pancreas, liver and thymus and kidneys. Tissues that are transplanted include tendons, skin, bones, valves, cornea, nerves and veins. Worldwide, the most commonly transplanted organs are kidneys, then liver and then the heart. Organ donors are living, or brain dead. Cadaver transplantation is the most challenging, complex and risky areas in the field of medical and surgical science. Overall transplantation requires patience, financial planning, ethical consideration, dedication and expertise of the medical team. It involves major risk of patient's life. But it is considered the most miraculous treatment of the century in the field of medical science. The present review is therefore planned to focus on its importance, types, history, need, process, medications and risks of organ transplantation.

Keywords: Transplantation, recipient, cadaver, organ

Introduction

The consequence of modern lifestyle diseases (diabetes and hypertension) has increased the emergence of organ failure across the globe including India. This, in turn, causes morbidity, mortality, poor quality of life including social and financial catastrophe of human health. Precious human lives can be saved if ethically good quality organs are retrieved from individuals and transplanted to a needy person in a prescribed period. India's death rate according to Central Intelligence Agency, is about 7 per 1000. Dead bodies are being burnt or buried without even thinking of organ donation to a needy person. Organs are natural working machines. As such, there is no any lab manufactured, factory-made human organ which takes over the functioning of the human body part. Transplantation comprises the processes of organ donation (OD) and subsequent implantation or grafting in a new body. Organ transplantation is now considered the only treatment for end state organ failures. Sometimes, due to one organ failure, another organ is failing and there is need of both organ transplant simultaneously in recipient's body (double transplant). But, such patient has longer waiting period than those with only one organ failure e.g. heart and lung transplant or kidney and pancreas transplant. There are various other alternative methods for kidney failure such as renal replacement therapies including dialysis, but kidney transplant in those patients are always advocated to have both for quality of life and cost effectiveness. The techniques such as Vascularized composite allografts (VCAs) are also popular these days which include multiple tissue transplant on face or hand. Overall the transplant process has become now quite feasible and convenient than those of earlier days (Sulania et al., 2016).

As there is not much awareness of organ transplantation in India, the common man is not having any idea regarding it. This paper is therefore an attempt to provide the basic information regarding a process of organ transplantation.

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Historical background

Actually speaking, transplantation of various organs is not a novelty of 20th century. It was already known since ancient

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times in one or other form. As per the Hindu mythology, Lord Ganesha is also having a transplanted elephant's head when Lord Shiva decapitated his son's head. In the 18th century, there were many experiments conducted on animals and humans for organ transplantation. It has a long history since the 1950's. On 23 December, 1954, the first successful transplant of kidney was performed at the Peter Bent Brigham Hospital in Boston between the identical Herrick twins. In India, first kidney was transplanted at the King Edward Memorial Hospital at Bombay in May 1965. The kidney was retrieved from cadaver donor and transplanted in a patient who had hypernephroma. The first transplant of human heart to another human was performed on 3 December 1967, at Groote Schuur Hospital in Cape Town by South African doctor, Dr. Christiaan Barnard. In India, Dr. Venugopal, a renowned cardiologist and cardiac surgeon, successfully transplanted heart in 1994. World's first liver was transplanted by Starzlin 1963. The first Deceased Donor Liver Transplant (DDLT) in India was done in 1995 but this attempt was unsuccessful. Following, few unsuccessful attempts further, first successful Living Donor Liver Transplant (LDLT) was performed in November 1998 by Rajashekar. Soon, most of the developed countries tried and gained success in organ transplantation. On the other hand, rising income, skilled and expert manpower, innovations and researches in medical fields, advanced technique, personal insurance and hopes of prolonged life expectancy gained wide popularity of organ donation and transplantation (Watson, 2012).

Organ donation process

Generally speaking, a person can register for organ donation prior to his death. In such cases, that person's relatives will have to donate his organs. The process of this donation starts from signing the written consent form in presence of at least two witnesses, out of which one should be 'near relative.' In cadaver donation, relatives can donate the patient's organs.

In case of the brain death of a person following severe brain injury or hemorrhage or trauma, consent is given by the close relative of the patient. Majority of times, relatives are not in a position, or not at all willing to give this consent because of their religious and familial issues. In such cases, extensive counselling is required by transplant counsellors for organ donation. Most of the relatives are persuading for donation after this counselling (Watson, 2012; Sulania, 2016; Shroff, 2009).

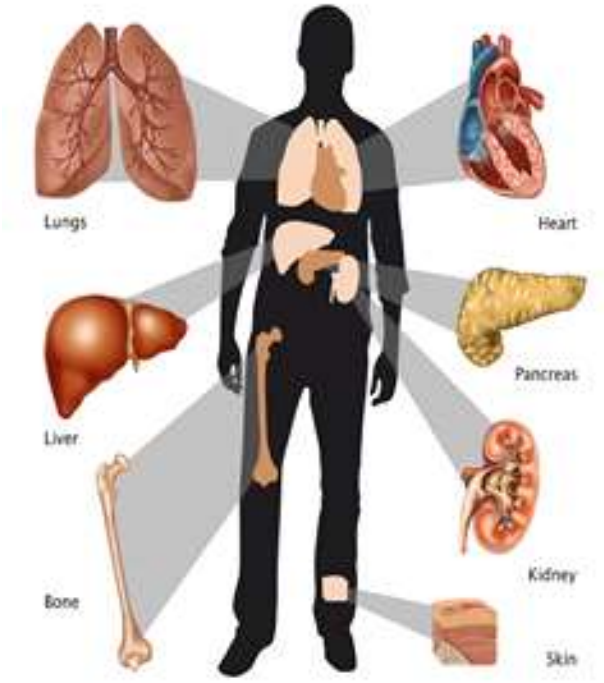

Figure 1. The end stage organ diseases that can be cured by transplants

There are two ways of organ donation

- Deceased organ donation: Donors are patients who die of a brain hemorrhage, stroke, and severe brain injury resulted in brain death and on a ventilator in the hospital's ICU.
- Living organ donation: it involved donating the organ in one family or close relative (Pimple and Saraf, 2016).

Types of transplant

1. Autograft: When one part of the body is transferred to another part of the same body then it is called as the autograft transplant.
2. Allograft: When two members of the same species which are genetically non-identical exchange organ, then it is called allograft transplant. Most of the human tissues and organ transplants are now day's allografts.

Table 1. The end stage organ diseases that can be cured by transplants

Sr. No.	Diseases	Transplanted organ/Tissues
1	Heart failure	Heart
2	Terminal lung illness	Lung
3	Kidney failure	Kidney
4	Liver failure	Liver
5	Diabetes	Pancreas
6	Corneal blindness	Cornea
7	Heart valve disease	Heart valve
8	Severe burns	Skin

3. Xenograft: When one species to another species organ are transplanted then it is called Xenograft transplant. E.g. Porcine heart valve transplant (Tikoo, 2017).

Laws and rules of organ transplantation

Human Organs Transplantation and Tissues Act came into force in India in 1994, to protect the interests of the organ donors and to promote organ transplantation in organ failure patients. The objective of this act is to regulate the removal of organ, storage of same and transplantation into recipients. Further, the retrieved organs must be utilized for therapeutic purposes only and not at all in commercial dealing. It is also having provisions about various committees and their role in the transplantation process (Al-Bar and Chamsi-Pasha, 2015).

Need of transplant

Due to various diseases like cystic fibrosis, polycystic kidney disease, heart failure, terminal lung illness, irreversible liver diseases or cancer, organs become weak day by day and not functioning properly. In addition organs are damaging due to certain infections like hepatitis, injuries to abdomen or organs, diseases like diabetes or hypertension. Such damage or injury to the organ results in severe pain and suffering due to which routine work becomes difficult and precious life turns troublesome. So the transplantation of new organs in such a person becomes utmost essential. In most cases, if organ is not received in time, a person will die (Human Organs Act, 1994) Therefore, undergoing an organ transplant will prolong a life with symptomatic relief. Also, the person's qualify of life is improved if he receives organ. e.g. need of dialysis is not there after kidney transplant, eye sight is restored following cornea transplant. The transplanted patients are also able to perform almost all activities later in their lives such as walking, climbing stairs, cycling, riding on a bike, etc (The factsheet, 2015).

Process of transplant

In India, the transplant process will commence when a doctor evaluates the patient as a recipient for an organ transplant and a person is put on the waiting list of organ transplant. Such patient is then referred to the transplant center in the city and asked to register in Zonal Transplant Coordination Committee (ZTCC) (Deshmukh, 2019). This committee maintains the waiting list for each organ like heart, kidney, lung and liver, as per the priority criteria given in state guidelines depending on patients' blood group. The patient's name is registered through the hospital. When there is a news of brain death of a person in any registered hospital, ZTCC is first informed. The ZTCC then allocates varies organs to a super urgent category of patients who are matched with blood group. If there are no super urgent patients or no matching of blood group, then that organs are transferred to the city waiting list. The ZTCC co-coordinators contact hospital coordinators who inform the patients about the availability of the organ. When an organ becomes available, the person on waiting list of transplant must immediately rush to hospital. He must have his bag packed and all reports filed in advance (Madhusoodanan, 2007).

Pre transplant tests

When a person is declared as the recipient of an organ transplant, he is evaluated more thoroughly and critically in the transplant center. The satisfactory result of these tests is the

Table 2. Transplant team detail

Team member	Role
Transplant physician (ICU practitioner)	He is doctor who is expert in the field of medicine (e.g., specialist of heart, kidney or liver). Supervision and complete care is taken by this physician.
Transplant Surgeon	They are well trained surgeons in field of surgery (e.g., heart surgery, liver surgery, abdominal surgery, etc.)
Transplant Pharmacist	They will dispense medications and guide the patients in taking them
Transplant Social Worker	Emotional and family support and practical suggestions is given by this social worker to help patient to obtain proper care and benefits. They also suggest social, psychological and financial resources available.
Transplant Dietitian	As diet is important part of this transplant, they are having expertise in nutrition and right meals suitable for patient. They supervise, plant and suggest diet to patient.
Financial Counselor	There people help to arrange various funds from govt organizations. They also help for billing, advance, settlement of accounts etc.
Anesthetics	To induce, manage anesthesia during surgery.
Osteologist, cardiologist, endocrinologist, pulmonologist, vascular surgeon, nephrologist	For suggestions in surgery in their respective fields.
The psychologist or psychiatrist	They assist in keeping normal mental state. They suggest some medication and help to keep good state of mind.

final green signal to the transplantation process. These tests include lung pressure measurement, complete blood count, blood sugar, ECG, 2D-Echo, HIV test, Blood pressure, bone density test, allergic tests, Chest X ray, ENT tests, eye-related tests, psychiatric tests, respiratory tests etc. Level of BNP (Brain natriuretic peptide) test is also important test to assess functioning of heart before heart transplant. The patient has to maintain and file all reports properly and handover to transplant team before surgery (Jonge et al., 2008).

Transplant team

The transplant team for any organ transplant is comprised of different members as mentioned in table 2 (Health and Human Services, 2008).

Financial planning

Transplant surgery is the most expensive treatment so far and the cost is not affordable to the common man in India. This procedure involves all the expenses before, during, and after the actual transplant surgery including the cost of medications given to a patient in waiting period. The recipient has to plan and arrange all these expenses on his own. The donor donates organ without any financial interest. The probable cost of transplant shall include:

- Laboratory tests before, during and after the surgery.
- Charges for the members of transplant team.
- Surgery, ICU and critical care charges.
- Hospital stays before and after surgery.
- Medicine charges throughout the entire course before and after surgery.
- Transportation of recipient to and from hospital for the initial tests and surgery.
- Rehabilitation, including physical or occupational therapy and physiotherapy.
- Post-transplant tests and visit to clinics for follow up and checkup.
- Air ambulance charges if any.
- Any other emergency charges.

Systemic financial planning is required for transplantation. Some health insurance companies may cover some of the cost. Fortunately, the recipient is not alone to take these financial decision or arrange such a big amount. In fact, members of the transplant team and the financial coordinators of the team can assist the patient to develop a plan and arrange moneys. Certain government organization, NGO, charity trust can provide financial assistance to needy people. In addition, chief minister fund, Prime Minister Fund, trust of rich temples also provide financial support (Health and Human Services, 2008).

Organ matching

The organs of donor and recipient are matched and allocated to recipients in waiting list depending on the policies framed under the Organ Procurement and Transplantation Network. The common factors taken into consideration during matching are blood group, tissue type, organ size, the distance between recipient and donor, age of donor and the recipient, and severity of patient illness. If the organ is matched, recipient is asked to admit immediately to the hospital and prepare for surgery (Kunkulol et al., 2018).

Green corridor

The green corridor is special transit arrangement carried out by traffic police and local police avoiding signals and making clear route to ambulance carrying organ. The objective of green corridor is that in transit organ should be reached to its destination in shortest possible time. Traffic polices are stationed at selected points to divert, control and clear the traffic giving way to the ambulance. If there is need to transport organ to different cities, then air ambulance can be used. (Koushal et al., 2018).

Surgery

Upon the arrival of patients a few hours before surgery, he is again evaluated for possible risks and complications associated with surgery. Certain tests are conducted to ensure good health of the patient before surgery. The preparation of surgery is carried out without wasting a single minute as the retrieved organ cannot survive outside the body for longer period. The surgeries may last for 4-8 hours until the patient become stable. In this surgery, the diseased organ is removed and new organ is properly kept in place and sewed. The surgeon then ensures the functioning of organ. After surgery, the patient is shifted to critical care unit and monitored critically for any infection or organ rejection in first 2-3 days. Then after some stability the patient is shifted to recovery room for monitoring and recovery. This period may last 2 weeks to 1 month. During this period various tests are performed to evaluate the patient. Sometimes, hospital stay will be more if patient is not settled satisfactorily. Patient is discharged after satisfactory recovery with proper course of medicines (Zawn Villines, 2019)

Risks and medication

No surgery is risk free. The risks are informed to relatives of patient in advance. All surgery requires signing of consent form by relatives prior to surgery. Some of the risks factors that are associated with organ transplant surgery include:

- Bleeding during the procedure.
- Use of anesthesia, its complication and death.
- Hyper or hypotension.
- Respiratory depression, cardiac arrest/collapse.
- Improper response to operation.
- An infection, as a postsurgical complication.

- Any other risk, such as illness, infection due to immunosuppressant or any other drugs.
- Rejection or failure of organs.

To avoid such risks, important tests are continuously performed during patients stay in hospital. These tests include the level of immunosuppressant drugs in blood, new organ functioning etc. If the patient becomes severely ill, there may be chance of organ rejection. In such cases, the dose of immunosuppressant drug is adjusted in a patient. 5-10 % chance of even death cannot be denied following surgery. The patient has to take such anti-rejection drugs throughout their entire life to support their long term health. These drugs weaken the immune system and thereby prevent rejection, due to which the ability to fight with infection is reduced, and there are greater chances of infections (Freeman and Cohen, 2009). To avoid infections, the patient is kept under sterile condition and antiviral drugs, antibacterial drugs, anti-microbial drugs, antidiabetic drugs and antihypertensive are given to patient. In home also, the relative has to take proper care of patient and feed him fresh, hot diet and drinking water. Patient is instructed to avoid attending ceremonies, parties, weddings, functions and avoid outside visits for 4-6 months. The relatives are also restricted at home. The patient has to take their prescribed medications about one year after transplant till patient become safe. He is called for routine follow up and checking in private vehicle. The doses of medications are reduced or some medications are stopped after 6 months depending on patient health. Patient can resume his routine works after 6 months depending on condition (Guidelines of transplant, 2019).

Quality of life post transplantation

The main aim of transplantation is not only to provide patient life but also to offer him a good health same as he enjoyed before the disease. Further, the operation ensures good balance between mental, emotional and physical efficacy and psychological integrity. Quality of life is also assessed which evaluate the social, psychological and physical parameters of patients health. Clinically, because of immunosuppressive therapy, various patients are having risks of medical complications (Rauch and Kneen, 1989). Previous history of diabetes or hypertension is major risk factor for organ transplant. Such patients may also show changes in their family behavior, medical staff because of this lengthy and risky disease. Some people lost hope of life before the surgery. Some sort of chronic depression is also noted in patients. After surgery, majority of these things are reversed. Some patient feels extreme gratitude because they have experienced rebirth to a new life following rituals of death (Dew et al., 2005).

After the surgery, the health of patient is improved, sleeping pattern and eating habits normalized, there is no depression, the patient can enjoy his rest of life further. He can also mix socially, and participate in day to day activities and can do everything which he previously enjoyed (Muehrer and Becker, 2005).

Conclusion

Organ transplant is an important, safe and last line therapy for patients and it gives new hope and life to thousands of people. Many people die as they are not receiving organs in time. Currently there are approximately 3,500 to 4,000 kidney transplants are performed annually over 120 transplant centers in India. There are various programs going across the cities to promote organ donation and make awareness regarding organ transplantation. It cannot be predicted that how many years the transplanted patient will be surviving but it is clear that organ transplant has proved a successful and miraculous medical treatment in the patients, postponing their death and relieving their symptoms (Muehrer and Becker, 2005).

Conflict of Interest

The authors declare that there is no conflict of interest in publication of this paper.

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