

OPEN TEXT BASED ASSESSMENT 2016-17

Biology (044) Class - XI

Theme 1: Long Live Humanity

Learning Objectives

- ☐ To make the students aware of organ donation and transplantation processes.
- ☐ To sensitize the students with policies and priorities given to the patients for organ transplantation.
- ☐ To analyze the reasons behind less number of organ donations.
- ☐ To appreciate the voluntary contribution of living donors.
- ☐ To understand the responsibilities of general public for recycling of organs.

A note to readers

Following text passage is designed to understand the value of long live humanity through organ donation services. Living and cadaver donors are identified as main types of donors. While views of organ donation are positive but still there is a large gap between the numbers of registered donors compared to those awaiting organ donations on a global level. Awareness about organ donation leads to greater social support for organ donation. To be considered as a living organ donor a person should contact a hospital with a transplant centre. A list of transplant centres can be found through the Organ Procurement and Transplantation Network, NOTTO (National Organ and Tissue Transplant Organisation)

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Abstract

What began with the kidney has now expanded to hearts, lungs, livers and other organs. Development of cadaveric and living organ donation practices, deciding who can donate organs has been a flexible and changing process, starting with living donors and then moving to include deceased and brain dead donors. The debate about increasing and restricting the pool of eligible donors continues today.

Development of anti-rejection drugs have done wonders to increase the success of organ transplants. This intriguing field of study becomes more attractive to some researchers as the number of people needing organ transplants through donation continues to grow. Stem cell research is examining adult and human embryo cells in an attempt to discover how organs are developed and what stimulates their growth.

The way humans die has changed significantly during the past half-century. Once a sudden and unexpected event, death has become an actively managed and often prolonged process that occurs more often in hospitals than in the community. Advances in healthcare, in particular, have transformed the way we die. Organ failure, for example, is no longer inextricably linked to death. Patients with end-stage renal disease are routinely dialyzed for many years. The lives of patients with cardiac failure can be prolonged with inotropic and chronotropic therapies, and patients with respiratory failure can receive invasive and non-invasive ventilation in hospital or at home. Also, for more than 100,000 patients per year of the estimated 1.7 million patients worldwide in need of transplant for failing organs, the transplantation of organs and tissues from patients that have died in intensive care settings provide significant benefits - reducing mortality and morbidity, increasing long-term survival, increasing quality of life and reducing the economic burden of the cost of healthcare for patients with chronic diseases.

Organ transplantation -- the surgical removal of a healthy organ from one person and its transplantation into another person whose organ has failed or was injured -- is often life-saving and gives the recipient a wonderful new lease of life. But organ transplantation is also a major surgery that carries potential risks and drawbacks, such as the chance of organ rejection. That's precisely why you and your loved ones need to gather as much information as possible on organ transplants.

Organ donation is the donation of biological tissue or an organ of the human body from a living or dead person to a living recipient in need of a transplantation. The lungs, heart, liver, intestine, kidneys, pancreas, cornea, skin, bone marrow, heart valves, middle ear and tendons of brain dead patients can be used in other patients.

Organs & Tissues for Donation

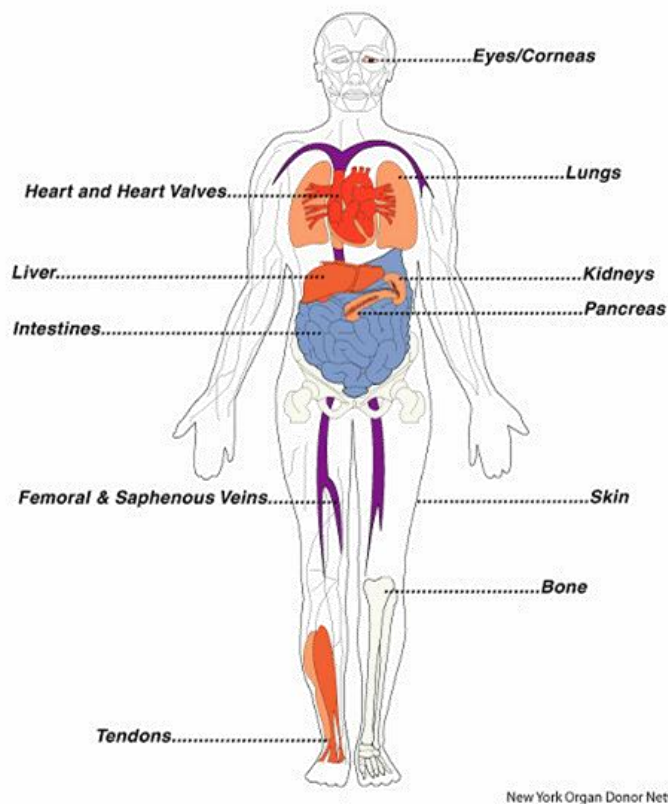


Fig 1: Different Organs used for donation

Organ donation and transplants are one of the most miraculous achievements of modern medicine. But they depend entirely on the generosity of donors and their families who are willing to make this life saving gift to others. In India, transplantation of human organs Act, 1994 legalised Brain Death and removal of organs for therapeutic purposes. It also banned commercial trading of organs from living unrelated donors.

Knowledge and Attitude towards Organ Donation

Of course, it does take a lot of courage for the grieving families to let the doctors harvest the organs of their loved ones. That too, at a time when they are just coming in terms with the irreparable loss of their family member. But by donating organs, they will set an example for others to follow. However, more needs to be done. Consider this: In India, less than 5,000 kidney transplants are carried out annually against an estimated requirement of over 175,000. Similarly, only 1,000 liver transplants are performed every year where over 50,000 perish due to end-stage liver diseases. The annual requirement of hearts is estimated at around 50,000 and lungs about 20,000.

Today in India the demand of organs for transplantation far exceeds the supply. Transplant technology and surgical methods continue to improve the enhancing chances of survival and

improved quality of life for the recipient. But this rapid enhancement in research related to transplant technology is not accompanied by a parallel increase in the availability of donor organs. The success of deceased donor programmes is dependent on knowledge and attitude of people towards organ donation.

Further studies found that 42 % persons are willing to be organ donors, 48% are undecided in urban areas, which is a large percentage of people who on effective dissemination of knowledge could be convinced to be donors. Reasons for unwillingness to be a donor may be fear of misuse of organs by medical personnel and lack of knowledge about procedure of organ donation. Three basic areas of donor risks: Surgical risks, Long-term health impacts, Emotional/psychological impacts. Small surgical issues include problems with anesthesia, infection, wound healing issues, collapsed lung fluid in the lungs (pneumonia) and pain. Long term health impacts include common misconceptions like donor will get kidney disease/failure, donor's lifespan will be shorter and donor will need major lifestyle adjustments for one kidney. Psychological impacts include: fear that the donor may have regrets, emotional struggles are not common, but possible; more likely if the transplant does not go as planned.

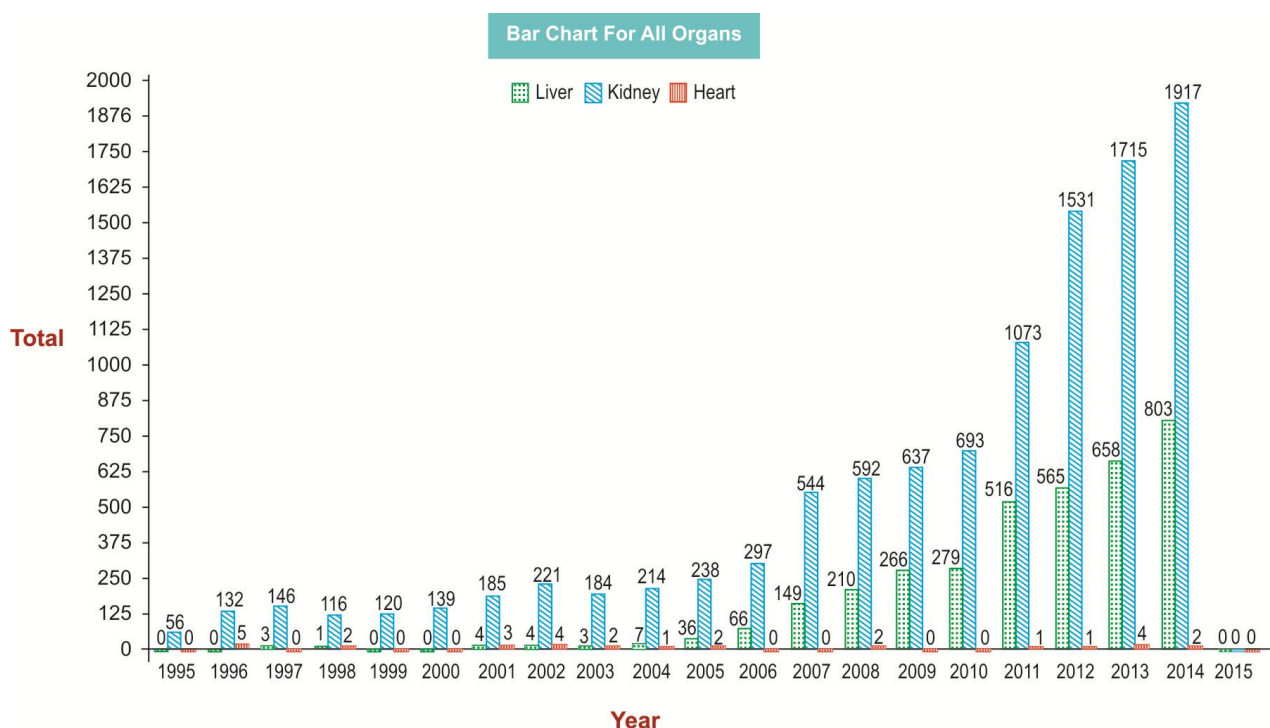


Fig 2: Statistical Analysis of donated organs (Year wise)

Types of donors

Majorly there are two types of donors: living donors and cadaver donors and two types of deaths: cardiac death and brain death. Conditions that progress to brain death include lethal head injury, brain hemorrhage. Brain death is irreversible loss of consciousness, absence of respiration, flat EEG, loss of brain stem reflexes. Brain death tests include: no pupillary response to light, no eye

movement following irrigation of the ear canal with ice water, no response to corneal stimulation, no cough or gag reflex, no spontaneous breathing. Brain dead patients are always kept in the intensive care unit of the hospital and their blood pressure and respiration are artificially maintained.

Certain facts for End Stage Renal Disease (ESRD)

About two lakh people need kidney transplant every year. About 6000 transplants are done every year but only 600 use cadaver donations. Kidney failure can be a gradual process and symptoms may not be seen until the disease is very advanced. Kidney failure occurs when the kidneys are no longer able to remove waste and maintain fluid balance in the body. Without some form of treatment, this would result in death. The two types of treatment for kidney failure are dialysis or transplantation. There are two different kinds of dialysis: hemodialysis or peritoneal dialysis. Kidney transplantation is the third option for people with chronic kidney failure. In a kidney transplant, the donated kidney is surgically placed in the lower abdominal area and replaces the function of the natural kidneys.

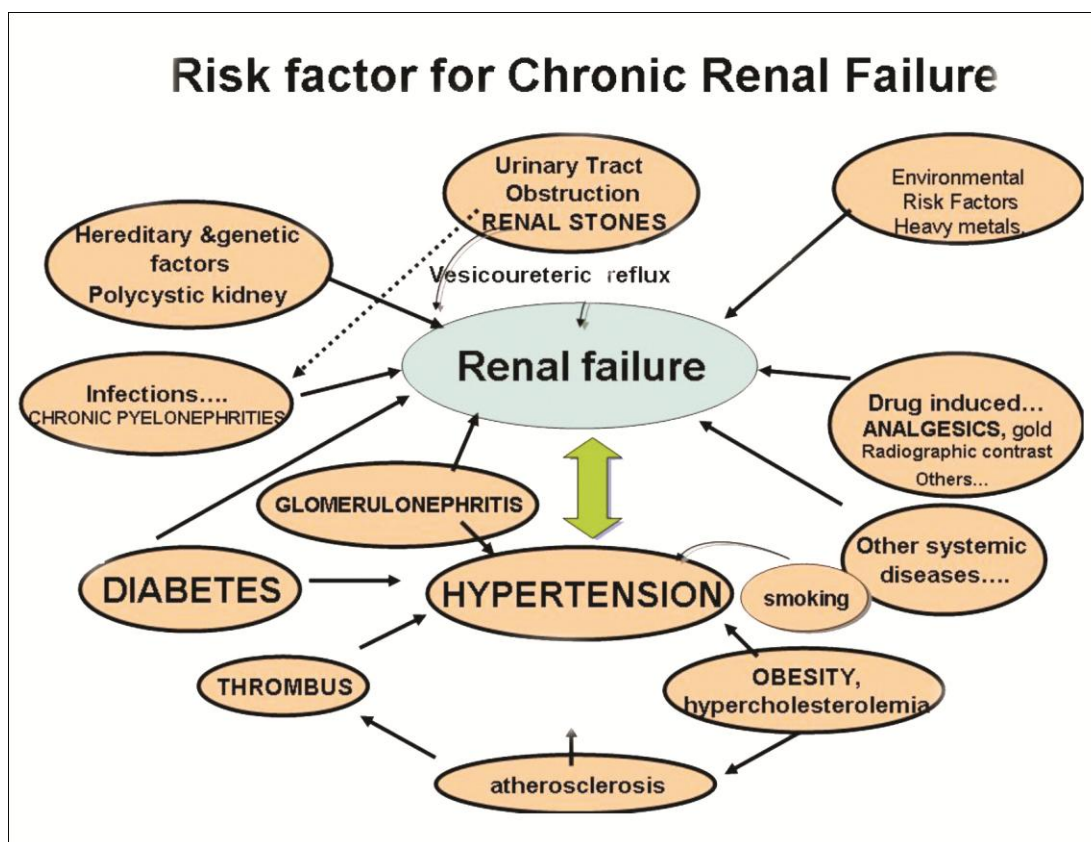


Fig 3: Various Reasons for Kidney failure

There is disparity between number of recipients requiring kidney transplant and the number of organs available for kidney transplantation because some patients need kidney on urgent basis, delay may lead to mortality. For ESRD maintenance dialysis is acceptable. There are allocation

principles, algorithms and criteria set for regional/state and national level by National Organ and Tissue Transplant Organization to decide on the priority for receiving the organ.

SCORING SYSTEM FOR MAKING PRIORITY

Sl. No.	Criteria for scoring	Points allotted
1	Time on dialysis	(+1) for each month on dialysis
2	Previous immunological graft failure within 3 months of transplantation	(+3) for each graft failure
3	Age of recipient	(+3) for less than 6 years (+2) for 6 to less than 12 years (+1) for 12 to less than 18 years
4	Patient on temporary Vascular access	
(a)	With Failed all AV Fistula sites	(+ 2)
(b)	With Failed AV Graft after all failed AVF sites	(+ 4)
5	PRA (Panel Reactive Antibody)	(+ 0.5) for every 10% above 20%
6	Previous Living donor now requiring Kidney Transplant	(+5)
7	Near relative (as per definition of THOTA) of previous deceased donor requiring kidney transplant	(+5)

Note: Patients with the same score, priority will be decided based on the seniority in the waiting list

Fig 4: Priority of waiting list

Heart Transplant and Organ Donation

Heart transplants are done soon after brain death of the donor is determined. Machines keep the heart and other organs functioning until the transplant teams arrive. The team needs to move quickly in order to obtain the heart in the best possible condition.

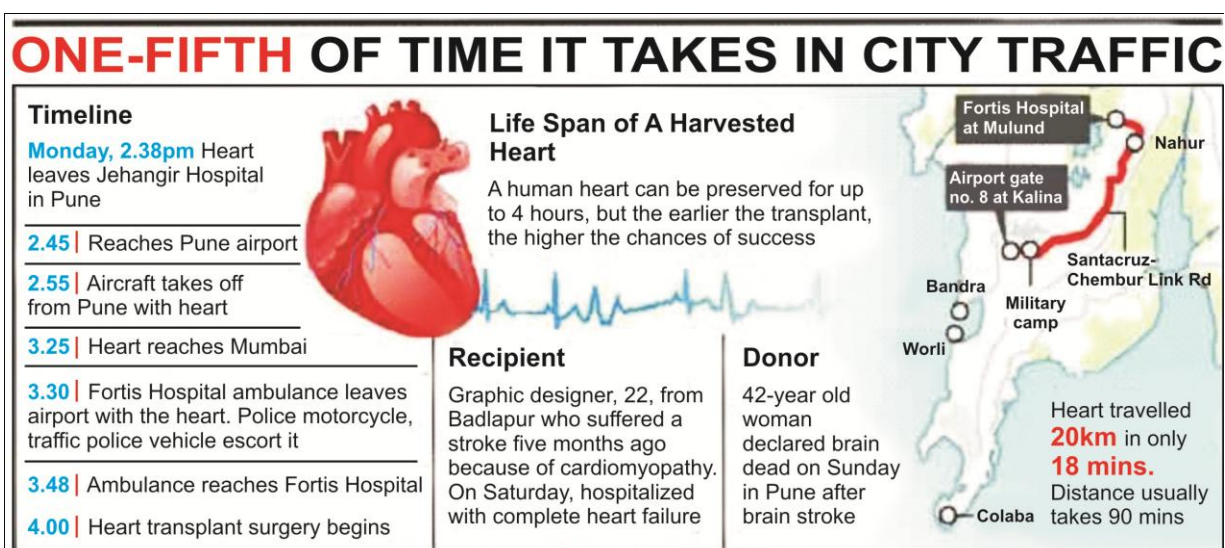


Fig 5: Timeline for a harvested Heart

Until 2013, as many as 250 donor hearts used to be discarded in the every city as medical waste even as thousands of people died of end-stage heart disease. Three years on, there has been a five-fold rise in heart transplants in Tamil Nadu. According to data sourced from the Tamil Nadu organ-sharing registry, the number of heart transplants rose from 16 in 2013 to 64 in 2015. In 2016, till May 4, 26 hearts were transplanted from brain dead donors. The mortality rate of people who make it to the list is around 35%. Ironically, the waiting time for a donor heart is lesser compared to other organs. Heart transplant was usually recommended for people with a survival rate of less than 70% within a year's span. "Their heart may be weak but we need them to be otherwise fit for the transplant. While those awaiting kidney transplants can be kept alive on dialysis, heart pumps are too expensive for most people. In the country, only Chennai, Hyderabad, Delhi, Bengaluru, Kochi, Mumbai and Visakhapatnam have done heart transplants.

Green corridors help transport organs in minutes

NEW DELHI, PTI: A live heart was transported from IGI Airport here to Medanta Hospital in Gurgaon in 16 minutes and a liver was rushed to the institute of Liver and Biliary Sciences in 15 minutes with the help of green corridors put in place by Delhi and Gurgaon police.

While the heart was transplanted in a 35-year-old woman suffering from end-stage heart disease at Medanta, the liver went to ILBS and was transplanted in a 55-year-old man

suffering from liver failure. The organs belonged to an 18-year-old Deepak Dhaketa who was declared brain dead by doctors following a road accident at Sri Aurobindo Institute of Medical Sciences (SAIMS) in Indore on April 27. His kidneys were transplanted into two patients at SAIMS and Choithram Hospital and Research Centre in Indore. Two green corridors were created from the IGI Airport-one for Gurgaon and another for Vasant Kunj.

A liver was rushed to the Institute of Liver and Biliary Sciences in 15 minutes with the help of green corridor

"The heart arrived at the IGI airport around 1.15 pm and was immediately rushed to Medanta Hospital. Green corridor was created on the National Highway to ensure that it reached the destination covering 18 kilometres within 16 minutes.

"The liver arrived at 1.58 pm and was transported to ILBS. The ambulance covered 11.4 kilometers in 15 minutes," Shared Aggarwal, joint commissioner, Traffic said. Delhi and Gurgaon traffic police coordinated to create the green corridor on the National Highway and all entry and exit points on NH8 were closed to facilitate smooth movement. "The crucial aspect in cases of heart transplant is that the time span between the harvesting of the organ to

its implantation should not exceed four hours. "The details of this 35-year-old woman was already there at the National Organ and Tissue Transplant Organization (NOTTO) where cases of people waiting for a donor are registered. The blood group of the recipient matched with that of the donor and the heart was allotted to her," Cardiovascular Surgeon and Managing Director of Medanta Medicity Dr. Naresh Trehan said. Dr. Anil Bhan, Cardiac Surgeon and his team from

Medanta had brought the heart from Indore in a private aircraft. "Green corridor were created with the help of police and the heart was successfully transplanted in the patient. So here the challenge was how to get it from Indore, transplant it and make it work in four hours. Even an half-an-hour delay could have caused problem. In such cases every minute counts," Dr Trehan said. Even the patient at ILBS was in a critical condition, said a senior doctor.

Fig 6: Green Corridors

Therapeutic Factors

Additional factors to be evaluated before the organ procurement organization selects the appropriate candidate are:

A. Is the patient available and willing to be transplanted immediately?

B. Is the patient healthy enough to be transplanted?

- ☐ Once the appropriate candidate is located, the organ procurement organization takes the organ and delivers it to the transplant centre where the transplant will be performed.
- ☐ When the transplant patient is ready for the donor organ, the transplant centre then surgically removes and replaces the failed or failing organ by following general procedure.
- ☐ After the transplant, the patient embarks on a long road to recovery.
- ☐ If surgery goes well, the patient may face the possibility of rejection.

Graft Rejection

- ABO blood group antigens- recipients should receive a graft that is ABO compatible. Permissible transplants are-
 - Group O donor to Grp O,A,B or ABO recipient
 - Group A donor to Grp A or AB recipient
 - Grp B donor to Grp B or AB recipient
 - Grp AB donor to Grp AB recipient
- HLA antigens- are most common cause of graft rejection, act as antigen recognition units
 - HLA –A,-B(Class I) and –DR(class II) are most important In organ transplant
 - Anti HLA antibodies may cause hyperacute rejection

Fig 7: Showing Compatibility chart for organ transplantation

- ❑ **Rejection** is the process where the body fights off the newly implanted organ. Rejection is harmful to transplant success because the body fights off the new organ as it would a virus or bacteria. In fact, the body's immune system treats the organ as it would any other harmful foreign invader. The immune system makes proteins called **antibodies** that go to the transplanted organ and try to kill it. In order to hold back the antibodies that threaten the new organ, transplant patients have to take powerful **immunosuppressant drugs** to keep the level of antibodies down, low enough for the organ to integrate into the body and start working.

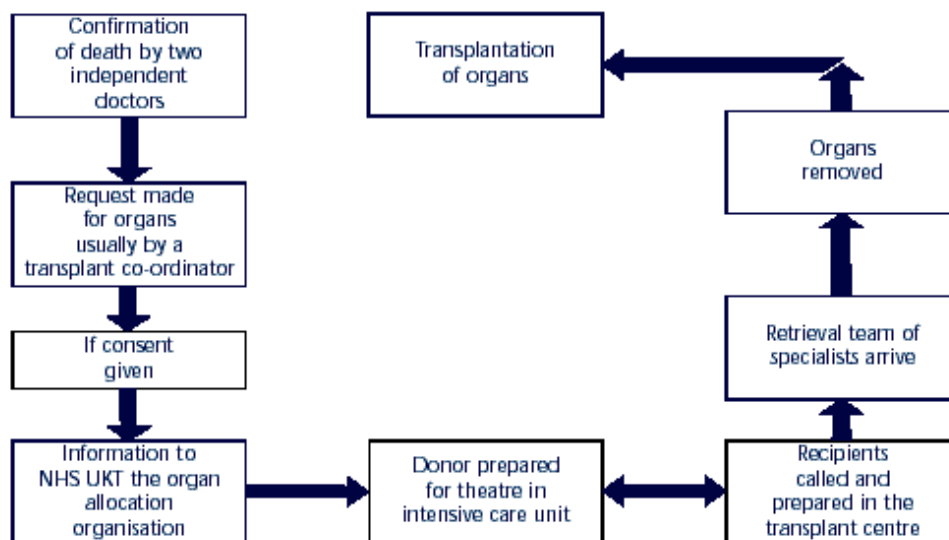


Fig 8: Procedure for transplantation of organs

Recycle Your Life: Be an Organ Donor

- ❑ Discuss with your family members
- ❑ Register on government websites (www.notto.nic.in) for organ donation
- ❑ Get organ donor card.

NOTTO
National Organ & Tissue Transplant Organisation

Directorate General of Health Services
MINISTRY OF HEALTH & FAMILY WELFARE
GOVERNMENT OF INDIA

Date: 04/06/2014 Registration ID: D14000001

I, Test Notto s/o sa, hereby pledge to donate the following Organ(s) and/or Tissue(s) from my body for therapeutic purposes after being declared brain stem dead.

Organ(s) : Liver, Kidney, Heart
Tissue(s) : Bone, Heart Valve, Cornea, Cartilage

Blood Group : B+ Pan Card "EC16476464"
Date of Birth : 02/10/1991 Emergency Mobile No : 1457268746

Fig 9: Sample of Donor Card

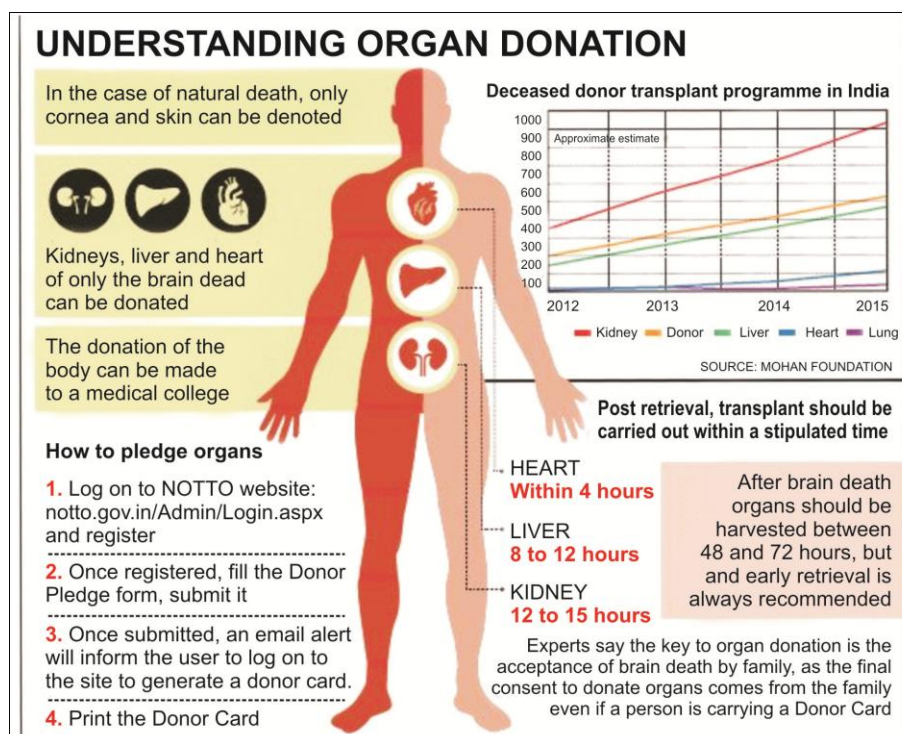


Fig 10: Procedure for organ donation

There is an urgent need for increased public awareness regarding organ donation and greater effort must be taken to dispel public concerns regarding the same. Organ donation can give a new twist to tragedy. Remember "organs wasted are lives lost". There are many social organizations like Rotary

clubs and various NGOs that works toward spreading awareness about cadaver organ donation. Their main aim is to educate the people as well as the medical professionals about the importance of organ donation and transplantation. They spread the word about cadaver organ donation through presentations at schools, colleges, religious gatherings, festival celebrations and corporate firms; TV advertisements; social media and print media; and cinemas. They have also conducted door to door awareness campaigns.

The most common causes of death are diseases of organs like heart, lungs, liver, kidneys and pancreas and these are potentially treated with organ transplantation, but our immune system rejects the allograft. **Muromonab-CD3** is an immuno suppressant drug given to reduce acute rejection in patients with organ transplants. **Stem cell** research is not only promising for developing much needed organs, but for understanding how to slow down rejection of transplantable devices **Tissue engineering**: is the use of a combination of cells, engineering and materials methods, and suitable biochemical and physicochemical factors to improve or replace biological functions.

Organ donation and transplantation is complex and costly and there is no state funding for this procedure. Most of the activity in deceased donation has been in the private sector. A significant number of donors and a large majority of recipients are from private hospitals and the large majority of the organs currently go to the rich. One method of developing equity in distribution system of organs could be to mandatorily allocate a proportion of organs for public sector institutions.

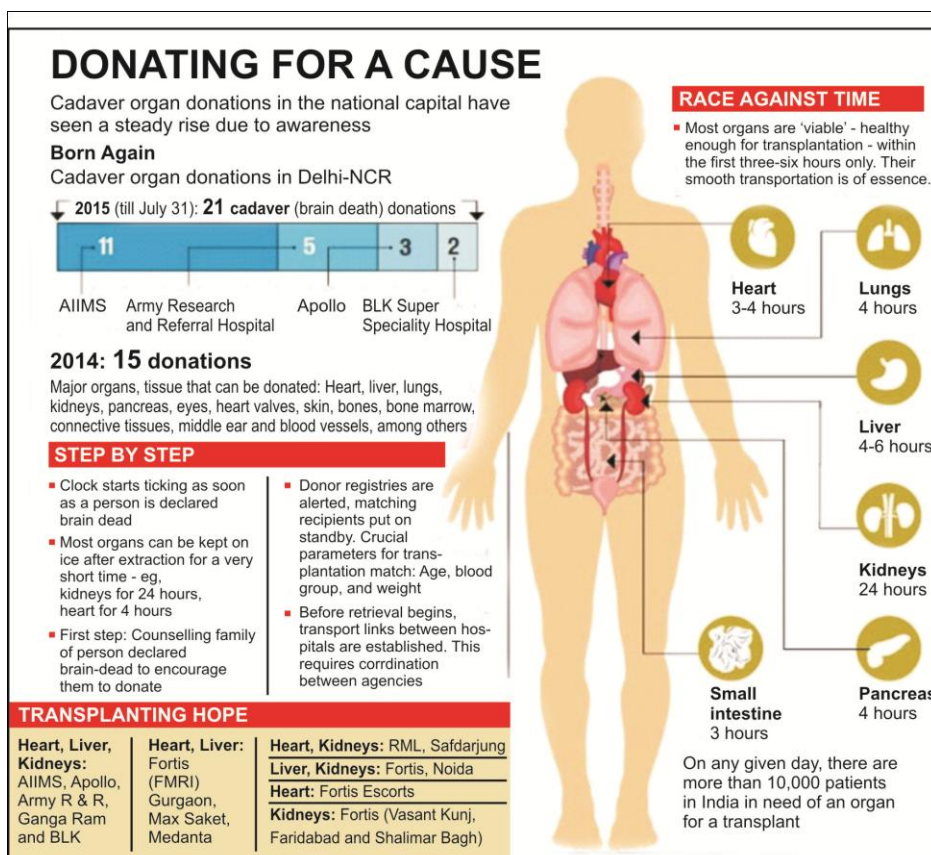


Fig 11: Summary of organ Donation

For instance, it should be made mandatory for all hospitals to ascertain and certify brain-death cases. Once a patient is certified brain-dead, multiple organs including heart, kidney, lung, liver, pancreas and tissues can be harvested and transplanted to the needy patient. The Government has set up a National Organ and Tissue Transplant Organisation (NOTTO), a national level body, to function as apex centre for coordination and networking for procurement and distribution of organs and tissues and their registry. So far, 100 super-specialty hospitals from across the country have enrolled with it, giving details of their organ transplantation activities.

We must continuously strive towards increasing donation rates. We in India need to develop a system which is neither dogmatic nor coercive but equitable and transparent. This will be a slow and difficult process that may also require linking to the bigger struggle for an advanced and yet affordable healthcare system for all.

References


- ❑ www.donatelifeindia.org
- ❑ www.scientificamerican.com
- ❑ www.eurostemcell.org
- ❑ www.notto.nic.in

Sample Questions

1. Reflect the all possible reasons for unawareness in general public regarding donation of vital organs. (5)
2. Enumerate the suggestive norms and strategies to be used for organ and tissue donation. (5)

Marking scheme

1.
 - (i) Lack of knowledge about the biological functioning of the body. (1)
 - (ii) Less publicity by govt and non-govt agencies (1)
 - (iii) Parents do not explain about it to their children due to psychological fear (1)
 - (iv) Rare articles in newspapers and magazines regarding recycling of organs. (1)
 - (v) No such units in hospitals like blood banks (1)
2.
 - (i) There should be essential certification of brain deaths in private as well as public hospitals. (1)
 - (ii) Relatives of living and cadaver donors should be counselled to donate the organs. (1)

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- (iii) Laws of transplantation and donation should be strictly followed to give preference to the needy patients of wait list. (1)
 - (iv) Toll Free helpline numbers of green corridors and organ donation centres should be pasted at specific places in private and public healthcare centres. (1)
 - (v) Strict action should be taken against the organ trafficking. (Human trafficking and transportation control Act 2007. (1)