3. REVIEW OF LITERATURE

3.1 Introduction

Advances in medicine and surgery have resulted in organ and tissue transplantation being transformed over last 30 years from being an experimental procedure being performed in highly developed countries to being a therapeutic intervention being carried out routinely in hospitals around the world. [6]

Today cases of organ failure are increasingly seen. Organ transplantation is the best and most economical treatment for cases of organ failure.

Organ donation is the noble act of donating one’s healthy organs to another person in whom those organs are no longer functioning. These donated organs are transplanted surgically into patients who suffer from failure of those organs and in whom the transplanted organ begins to function. That person whose organ is removed for the transplantation is called as a donor and the persons who receive the transplanted organs are called as the recipients. For a very large percentage of patients transplant of donated organs is the only ray of hope in treatment. Organs that can be donated include heart, liver, kidney, pancreas, intestine, lungs and the tissues include cornea, skin, bones and ligaments and many others. With advances in medical science this number will only increase.

Donors

A “Donor” has been defined by “The transplantation of human organs Act 1994 Act no 42” as a person who voluntarily authorizes the removal of any of his human organs for therapeutic purposes. [11]

The donors can be:

1. Brain-dead organ donors (organ donation after brain death-DBD)
2. Non-heart beating cadaver organ donor (organ donation after cardiac death-DCD)
3. Live organ donor

A living donor is a person who donates his organs while he/she is alive. At such times very few organs can be donated as the donor should be able to live a normal healthy life after the organ donation. Kidneys are the most donated organs by a living donor because it is possible to survive with just one kidney. The other possibility of living donation is by donating part of an organ. This includes parts of liver, lung, pancreas and intestines. [9]

On the other hand, the deceased donor, also called as the cadaveric donor, is a person who has been declared as brain dead. Majority of organs all over the world are taken
from such donors rather than from living donors. Today in USA almost 56% of the donors are deceased donors. A deceased donor can donate more organs than a living and can save up to eight lives and make a difference in lives of many more. By promoting deceased organ donation, the number of available organs will increase much more than that by promoting living organ donation. [9]

Organ donation can also be done by individuals who are declared dead according to cardiopulmonary criteria i.e. when cardiac function ceases. Such donors are called as non-heart beating donors. [12]
3.2 Brain dead donor and donation following brain death (DBD):

Any individual whose brain stem, is irreparably damaged is declared “brain dead”. The cause of brain death can be a large stroke, massive trauma to head as in road traffic accidents or penetrating wounds to head such as bullet injury etc. The trauma stops all brain functions although all other body organs may continue to function normally.[12]

History of Brain death:

Despite the importance of brain death in the activity of organ donation and transplantation, the concept of brain death was not conceived in relation to organ transplantation at all. [14]

In early 19th century there were reports of cases where increased intracranial pressure following head injury resulted in respiratory failure with continuation of cardiac function for some time. In 1902 there was a report that when death is due to fatal increase in intracranial tension, respiratory arrest precedes that of the heart. In 1938, researchers proved that by occlusion of carotid artery in cats it was possible to occlude electrical potentials in brain. This was said to be death due to occlusion of blood supply to brain. In 1959 there were reports of “death of nervous system” and a condition called as “coma de´passe´” which was described as an irreversible state of apnoea and coma. Authors proposed stopping of the ventilator if death of the nervous system was diagnosed clinically and by repeated electroencephalographic examination showing absence of electric activity.[14]

In 1959, there was report of a condition of deep coma with no spontaneous respiration and absence of electroencephalography (EEG) activity. The authors observed that if the artificial ventilation was stopped the patient would rapidly die. However these doctors did not consider these patients as dead though this was considered as the earliest description of “brain death syndrome”.[14]

In 1968 the committee of the Harvard Medical School published a report describing the characteristics of a permanently nonfunctioning brain, condition referred to as “irreversible coma” today referred to as “brain death”. The characteristics included unreceptivity and unresponsivity to external stimuli, no movements or breathing, no reflexes and flat electroencephalogram. The report advised ruling out of drug intoxication and hypothermia. The committee stated their purpose for defining the criteria for irreversible coma. They stated that when resuscitative efforts have only partial success,
they may result in a patient whose heart continues to beat but his brain is irreversibly damaged. Such a patient places a huge burden on families as well as on hospitals where they occupy beds which are needed by other patients. If the patient meets the above defined criteria, then the family and treating personnel should be informed. Death should be declared and then the respirator should be tuned off. The report suggested new criteria for pronouncing death being “individual sustaining irreversible coma as a result of permanent brain damage”. Repeated examination over a period of 24 hours should be carried out to confirm irreversibility of the condition. After the Harvard committee report was published, brain death was widely accepted.[14]

Machado et al stated that concept of brain death evolved independent of the organ transplantation activity each having different origins. Hence the brain death was not developed to benefit transplantation. By the time the brain death criteria were stated by the Harvard committee, the first kidney, liver, lung, pancreas and heart transplant had already been performed. (Table 1) However the author also states that it cannot be denied that the final success of transplantation was improved by refinement in the concept of brain death.[14]

**World Medical Association (WMA):**[20]

Regarding the declaration of death and procurement of organs, the world medical association (WMA) made the following declaration:

- “Determination of death can be made on the basis of the irreversible cessation of all functions of the entire brain, including the brain stem, or the irreversible cessation of circulatory and respiratory functions”. This determination will be based on clinical judgment according to the accepted criteria for the same and if necessary supplemented by standard diagnostic procedures and should be made by a physician.
- “the physician who determines and/or certifies the death of a potential organ donor should not be involved in the organ removal or in subsequent transplantation procedures or responsible for the care of potential recipients of these organs”
- *Cessation of life at the cellular level is not necessary for determination of death*
- *Following determination of death, all attempts at resuscitation should be ceased.*
The organ may be retrieved provided the family consents to organ donation and other ethical and legal requirements have been fulfilled.

Table 1. Comparison between moments of development of concept of brain death and transplant surgeries.

<table>
<thead>
<tr>
<th>Transplants</th>
<th>Brain death</th>
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<tbody>
<tr>
<td>1902</td>
<td>First renal autotransplant</td>
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</table>

**1902–1950**

| 1906 | First xenotransplant in humans | 1929 | Berger discovers the EEG[^15] |
| 1933 | First kidney transplant from a cadaveric donor, without success | 1930 | Crile et al proposes a definition of death as a drop in electric potentials[^16] |
| 1938 | EEG is used to show loss of brain potentials after ischemia |
| 1939 | Crafoord proposes that death in animals whose carotid artery was occluded was due to the cessation of cerebral blood flow[^17] |

**1950-59**

| 1954 | First successful kidney transplant between identical twins | 1956 | Cerebral circulatory arrest is demonstrated in comatose patients by angiography |
| 1959 | Death of the nervous system coma de´passe´ |

**1960-68**

| 1962 | First successful kidney transplant from a cadaveric donor |
| 1963 | First successful liver and lung transplants from cadaveric donors | 1963 | First organ transplant using a brain-dead donor |
| 1966 | First successful pancreas transplant from a cadaveric donor | Schwab et al proposes to use the EEG for demonstrating death of the CNS[^18] |
Declaration of brain death in India

“The transplantation of human organs Act 1994 Act no 42 (THO Act)” the transplant Act of India describes “brain stem death” as the stage at which all functions of the brain stem have permanently and irreversibly ceased and is so certified.\(^{[11]}\)

ZTCC is a non government organization that was started to promote cadaver organ donation while implementing the deceased donor programme in accordance with the THO Act. It is responsible for equitable distribution of cadaveric organs. At present there are 4 ZTCC centers in Maharashtra namely Mumbai, Pune, Aurangabad and Nagpur. Each serves the area under its jurisdiction.\(^{[21, 22]}\)

In India as per the THO Act, the brain death is declared by the brain death committee which involves team of four doctors recognized by the Indian Government and who are not part of the transplant team. This death is declared in the hospitals recognized for transplantation. Brain death is accepted worldwide and the brain death certificate is issued to the relatives.\(^{[11]}\)

The state of brain death can only be diagnosed in the Intensive Care Unit while the patient is being supported on a ventilator since brain dead person cannot breathe on their own since the brain controls breathing. It is here that after the brain death has been declared, the relative of the patient are counseled to consider organ donation. If they give consent then only organ donation is done. This is called as ‘informed consent for organ donation” in which person has to opt for organ donation or opt for being an organ donor.\(^{[23]}\)

While in USA and most other countries of the world, family of the brain dead person must provide consent for organ or tissue donation, in many other countries such as France, consent is presumed and allowed unless family objects.

Legality of brain-death

Brain death is legal death. In India, The Human Organ Transplantation Act was passed in 1994 which mainly covers 3 areas.

- It recognizes brain stem death
- It regulates removal, storage and transplantation of organs for therapeutic purposes
- It prevents commercial dealings in human organs. No human organ can be bought or sold.
After the organ retrieval, the donor’s body is given back to the relatives to perform the last rites after the retrieval of organs. The organs are retrieved only for therapeutic purposes. \[21\]

This is different than body donation where the whole body is given to the Anatomy dept. of the Medical College for the research purpose.

Once a person is declared brain-dead the transplant centre whose patient is to receive the donated organ will dispatch a team of surgeons to procure the relevant organ. This procedure is carried out in the operation theatre of the donor’s hospital. The removed organs are preserved in a fashion to optimize their condition during storage and time of transportation. \[13\]

The donor in case of Donation after brain death (DBD) can be further classified in 2 subcategories. \[24\]

- Standard criteria donor (SCD)
- Expanded criteria donor (ECD)

A typical expanded criteria donor is a person who at the time of death is aged 60 years or above or is 50 to 59 years of age with any two of the following criteria:

1. Pre-existing history of systemic hypertension
2. Terminal serum creatinine >1.5 mg/dl
3. Cause of death is cerebrovascular accident

These are variables, presence of which increases the risk of graft failure by 70% compared with a standard criteria donor. They are also called as donors with “medical complexities”.

A standard criteria donor is a person who does not meet any of the above criteria and from whom donation occurred after brain death.

A brain dead donor can donate organs and tissues such as 2 kidneys, liver, 2 lungs, heart, pancreas, intestines, hands, face, cornea, heart valves, skin, bone, tendons, blood vessels, heart valves etc. \[2\]
Following are some of the issues pertaining to organ donation from a deceased brain dead individual.

Diagnosis of brain death.

- Goila and Pawar in their article on diagnosis of brain death in India, state that a large population of the world today understands that a person is dead when his or her brain is dead.\(^{[25]}\) However there is an acute need to diagnose brain death accurately because of increased awareness amongst the masses for an early diagnosis of brain death and of subsequent retrieval of organs for transplantation. The author describes the process of brain death certification as follows:

1. **Identification of history or physical examination findings** that provide a clear etiology of brain dysfunction.

2. **Exclusion of any condition** that might confound the subsequent examination of cortical or brainstem function. The authors state that shock, hypothermia, effect of many drugs can confound the clinical diagnosis of brain death.

3. **Performance of a complete neurological examination** including the standard apnea test and 10 minute apnea test.

4. **Assessment of brainstem reflexes.** The reflexes to be tested are pupillary response to light, corneal reflex, cranial nerve response to pain, cough reflex, gag reflex, oculovestibular and occulocephalic reflex.

5. **Clinical observations compatible with the diagnosis of brain death.** The authors state that certain clinical observations are compatible with the diagnosis of brain death. These observations may mislead the clinician into considering them as evidence of brain function. These include certain spontaneous movements of limbs, movements like respiratory movements, sweating, flushing, deep tendon reflexes etc.

6. **Responsibilities of physicians.** The diagnosis of brain death is primarily clinical. If the 2 assessments of brainstem reflexes and the apnoea test are positive, then no other tests are needed to diagnose brain death.

7. **Notify next of kin.** It is the responsibility of the treating doctor to inform the relatives that the testing for diagnosis of brain death is being carried out. However no consent is needed to carry out these tests.

8. **Interval observation period.** A period of 6 hours gap should be given between the 2 sets of tests.
9. **Repeat clinical assessment of brainstem reflexes.** Every testing or inability to conduct the testing should be documented.

10. **Confirmatory testing as indicated.** If all above tests are carried out then there is no need to conduct any ancillary test to diagnose brain death. However sometimes ancillary testing may be needed in case some of the tests cannot be carried out due to massive injury etc to the patient. They also may be needed to reassure the relatives of the brain death. The confirmatory tests include cerebral angiography, radionuclide angiography, MRI angiography, cerebral arteriography, electroencephalography and transcranial Doppler ultrasonography.

11. **Certification and brain death documentation:** Brain death should not be certified unless all aspects of brain death certification have been conducted.

The authors state that there is a difference between severe brain damage and brain death and that the physicians must be very vigilant while diagnosing brain death as its declaration is a prerequisite for organ retrieval for organ transplant.

**Omar Kasule** reviewed a number of articles on issues arising in brain death. He found that the motivation to diagnose brain death early could be to:

a) Harvest organs for transplant

b) Save intensive care unit resources

c) Obtain tissues for research purposes.

Such motives though noble cannot be justified. The determination of death should ethically be independent of other considerations like organ harvesting, cost control, or research. Further confusion was being created by the fact that there was no universal consensus on criteria for brain death diagnosis. The authors recommended the diagnosis of brainstem death on clinical consideration as there is no consensus on reliability of the instrumental confirmatory tests. [26]

**Sheerani et al** conducted a study to analyze the knowledge of health professionals in Sindh, Pakistan regarding concept of brain death. The study reported that 54% of the participating health care professionals did not have a clear idea of brain death, 47% would not turn off the ventilator even in a brain dead patient, 26% doctors considered it as euthanasia. Most doctors favored confirmatory tests like electroencephalogram to confirm diagnosis of brain death. The study highlighted the confusion among health
care professionals regarding brain death and stressed on including these aspects in medical curricula. [27]

**Ancillary testing for brain death diagnosis:**

Regarding the position of **ancillary tests** in diagnosis of brain death, there are variable views in different countries.

**Machado C** states that with regards to diagnosis of brain death the Cuban commission proposed that in case of people who were being tested for brain death, confirmatory tests were to be mandatory. These were classified into those that indicated absence of cerebral blood flow and those that indicated absence of bioelectrical activity. For testing of cerebral blood flow cerebral angiography, MRI angiography, multislice computed tomography (CT) angiography and CT perfusion, transcranial cerebral Doppler (TCD) ultrasonography were recommended. The authors finally state that an adequate medical practice would be to assess comatose patients by monitoring cerebral blood flow by TCD and neuronal activity by a combination of EEG, MEP and ERG in a test battery to study potential brain dead patients. [28]

**Chassé et al,** in a review of ancillary tests being conducted to diagnose brain death concluded that there are currently no ancillary tests which when used can support diagnosis of brain death completely and hence the necessity for complete and thorough clinical examination. [29]

**Wijdicks EF** states that determination of brain death is based on clinical assessment and confirmatory tests are not mandatory in USA. The author states that false positive or negative results for ancillary tests have been described. Pathological examination of the brain tissue has shown that considerable areas of viable brain tissue may remain in patients who can be clinically diagnosed as brain dead explaining the false negatives. [30]

**Wahlster S et al** assessed the practices and perceptions of physicians as regards brain death worldwide and found that fewer low income countries had an Institutional protocol for brain death compared to middle and higher income countries. It was observed that countries with an organized transplant network were more likely to have a brain death protocol in place. Even among countries having a brain death protocol in place, there was marked variability among the required examination findings with almost 53% of the responding physicians of the world reporting deviation from the American Academy Neurology Criteria. EEG was commonly reported as a required test by 53% of the respondents. The author concluded that there are substantial differences in perceptions of
brain death worldwide. Identifying these discrepancies, improving of the gaps in medical education and formalization of the brain death protocols in lower income countries are steps necessary to counter these differences. The author also expressed certain doubt as to possibility weather such a uniform standard for brain death diagnosis could be achieved worldwide. The author reported that in places where experts on brain death are not available, increased number of physicians is called upon to examine the patient. More than 50% of such respondent physicians expressed reluctance to declare brain death in the patient in this scenario. \[31\]

**Dhanvate** states that diagnosis of brain death in India is based only on clinical examination. Ancillary neurophysiological tests are not part of the diagnostic requirements for lawful declaration of brain death. However the author states that confirmatory tests may be carried out if the panel of doctors is in doubt or disagreement of the diagnosis. \[32\]

**Goila and Pawar** state that when clinical examination in the form of testing of brain stem reflexes as well as apnoea tests are conclusively performed there is no need for ancillary confirmatory testing. However in those patients in whom brain death cannot be clinically diagnosed and confirmed the ancillary testing may be needed to assure the family members and the medical staff. These tests can be angiography of various types, electroencephalography, cerebral arteriography, nuclear brain scanning, transcranial Doppler ultrasonography etc. \[25\]

Regarding the role of cerebral angiography and EEG for brain death diagnosis, **Shroff S** states that angiography can be used to show absence of blood flow in brain and confirm death of whole brain. However conducting the test is cumbersome in an unstable patient. It is also not necessary to carry out an EEG to diagnose brain death he says. He advises that if there is any doubt in the diagnosis of brain death one must not request for organ donation and instead should continue with the ventilator support. One may have to at times carry out special tests like isotope scanning or color flow duplex scanning of the cranium to confirm brain death. However these tests also can be inconclusive. The Author reiterates that the Transplantation of Human Organ act does not require investigations like cerebral angiography or EEG for brain death certification. \[11, 33\]
Transplantation of Human Organs Act n relation to diagnosis of brain death and ancillary testing for the same: \[1\]

The primary law related to organ donation and transplantation in India, the Transplantation of Human Organs Act (THO Act), was passed in 1994. It was aimed at regulating the removal, storage and transplantation of human organs. These would be used for therapeutic purposes and for prevention of commercial dealings in human organs.

The THO Act defines "brain-stem death" as the stage at which all functions of the brain-stem have permanently and irreversibly ceased and has been so certified. The Law states that this certification can be done by a board of medical experts consisting of:

(i) a registered medical practitioner in charge of the hospital in which brain-stem death has occurred;

(ii) an independent registered medical practitioner who is a specialist, to be nominated by the registered medical practitioner specified in clause (i), from the panel of names which have been approved by the Appropriate Authority;

(iii) a neurologist or a neurosurgeon to be nominated by the registered medical practitioner specified in clause (i), from the panel of names approved by the Appropriate Authority;

(iv) a registered medical practitioner treating the person whose brain-stem death has occurred.

The law was later amended to provide for the possibility of non-availability of the neurologist or the neurosurgeon. In such a situation the registered medical practitioner specified in clause (i), may nominate an independent registered medical practitioner who is a surgeon or a physician and an anesthetist or an intensivist who are themselves not a part of the transplantation team for this purpose.

The rules of the THO act require exclusion of confounding criteria such as ingestion of alcohol, drugs, muscle relaxants or presence of certain endocrine disorders etc. The act specifies the clinical tests for testing the brain stem functioning which is to be conducted twice with a time gap of minimum 6 hours. The act does not specify any necessity to conduct ancillary tests for diagnosis of brain death.

In a ruling in September 2012 the Public Health Department of Government of Maharashtra observed that Brain-Death is not being declared promptly. Patients who are brain dead are being kept on life support needlessly, delaying organ transplant to
needy patients. There is failure to declare brain death, even when patient shows all signs of such a condition, leading to prolongation of anxiety of concerned family members. On observing this, orders were issued making it mandatory to declare “brain-death” and certify it, and the certification of the same be conveyed to the Zonal Transplantation coordination committee for distribution of the organs. The order was applying to all Hospitals registered under Human Organ Transplant act 1994 and the non transplant organ retrieval centers (NTORCs) with immediate effect. \[34\]

**Organ wastage: Statistics of brain dead patients possible in India**

One brain dead person can save lives of 8 people and improve lives of several others. Following are the statistics of the possible brain death cases and organ donations in India:

- 1.5 lakh people go into brain death annually in India
- India needs about 2 lakh kidneys, 50000 hearts and livers each for transplantation every year.
- One person dies of kidney failure approximately every 5 minutes in India.
- If India were to manage to convert even 10% of these there will be no requirement for a live donor.

But so many of the above mentioned brain death cases go unrecognized and uncertified. \[35\]

**Awareness of Brain death among medical care professionals and among the people:**

**Wig et al** found that there was widespread acceptance in Indian population about organ transplantation but very poor awareness on the concept of brain death and its relation to organ donation activity. There was poor awareness regarding legality of brain death in India as well. This awareness was found to be poorer among the rural that among the urban population. \[36\]

**Singh et al** studied the level of awareness about transplantation, brain death and cadaveric organ donation in hospital staff in India and found that while 97% were aware of transplantation activity, 17.3% believed brain death to be a reversible process. 59.4% had misconceptions about retrieval of cadaver organs. A significant association was found between the workplace of the participating hospital staff members such as operation room or intensive care unit and awareness of transplantation. A significant positive correlation was also observed between awareness of transplantation, brain death and organ donation. \[37\]
Parekh et al conducted a survey to assess the level of knowledge of brain death and organ donation among the registered medical practitioners and found that 64.4% of the participating doctors had correct knowledge about the subject. This percentage increased to 90% after an educational session. The authors concluded that educational intervention on the subject of brain death and organ donation significantly increased the knowledge levels among the registered medical practitioners and was recommended. [38]

Hurdles within the ICUs

S M Gore worked on potential for organ procurement from intensive care units and the findings in a study carried out between 1st Jan to 31st March 1989 are as follows: The estimated number of deaths in ICUs was 3085, where in 407 patients brain stem death was a possible diagnosis out of which brain stem deaths were confirmed to be 282 (10%). Half of these patients became actual donors of solid organs. Out of the 407, tests for brain stem death were not performed in 106 cases. Out of the 282, 48 (17%) recorded general medical contraindication to organ donation. In 234 patients the criteria for brain stem death were fulfilled before cessation of heart beat and in the absence of any general medical contraindication to organ donation. Consent for organ donation was given in 152 cases when the possibility of organ donation was suggested to relatives. In 14 families there was no discussion of organ donation with relatives. Corneal suitability was recorded as "not known" in a high proportion 45% of all deaths and intensive care units reported only 123 corneal donors.

The study concluded that when brain stem death is a possible diagnosis, tests should always be carried out for confirmation and the transplant team should be referred to at the earliest in all cases of brain stem death to check contraindications to organ donation. Patients should be routinely assessed for suitability for corneal donation. More publicity and education are necessary to promote consent. [39]

SM Gore et al carried out a study regarding availability of transplantable organs from brain stem dead donors in ICUs. They concluded that some strategies can increase the supply of transplantable organs from brain stem dead potential donors in intensive care units. [40] They are

- reducing refusal by relatives,
- avoiding non-procurement of actually suitable organs and deterioration of initially suitable organs
- ensuring discussion with families on the topic of organ donation
3.3 Non heart beating cadaver organ donor (NHBD)/organ donation after cardiac death (DCD)

The list of patients waiting for organ donation is far more than the organ availability. Most success in organ donation has been seen with donation of organs by brain-dead cadavers or “heart beating” cadavers.

History of DCD organ donation: [14]

Machado states that all initial organ retrievals in the 1960s were done after taking the “brain dead” donor into the operation theatre. The respirator was then turned off and the medical personnel waited for the heart beats to stop. The patient was then declared dead by the cardiopulmonary criteria. Thus though the patients were brain dead, they were separately certified as dead after cessation of the heart beats. Thus it appears that all initial organ retrievals for organ transplants were from non heart beating cadaver organ donors.

With the Harvard criteria for brain dead donor being declared organ donations began to take place after brain death.[19]

Interest in organ donation after cardiocirculatory death, was renewed in early 1990s as a way to accommodate the high demand for organs which was not being met by donated organs obtained from brain dead donors. [41]

Efforts were now being made to acquire organs also from donors following cardiac death. Here the death was declared on the basis of the cardiopulmonary criteria i.e. “irreversible cessation of circulatory and respiratory functions”. [42]

In 2000 the Institute of Medicine recommended that “all organ procurement organizations should explore the option of non heart beating organ transplantation in cooperation with local hospitals, health care professionals and communities”. [43]

In the recent times:

Recent times have seen rapid increase in the rate of organ recovery from this category of donors and successful transplants with organs obtained from such non-heart-beating donors. This has potential to increase the number of organ donations and thus of procurement of organs. [44]

Sometimes a person suffers a severe brain injury with a dismal neurological prognosis, but fails to meet the strict criteria for brain death as there is still some detectable brain function. In such a case, the patient’s family may be counseled to withdraw life-sustaining medical support and also regarding subsequent organ donation. With the
consent of the family, life sustaining measures are withdrawn under controlled circumstances in the intensive care unit or the operating room. \[42\]

The patient’s physician who is a person not involved in any aspects of organ transplantation, determines when the heart stops beating and declares the patient’s death. The retrieval of organs such as kidneys, pancreas, lungs and in rare cases the heart is then carried out. \[42\]

The outcomes for organs transplanted following cardiac death are almost similar to that following brain death. In such cardiac dead patients the organs undergoing transplant face injury twice.

- The first injury is during the time period between cutting off of the life support and death when the organs gradually receive lesser and lesser oxygen.
- The second injury is during the minutes after death until the organs are removed and perfused with preservation solution and cooled. \[42\]

Warm ischemic time can be defined as the amount of time that an organ remains at body temperature after its blood supply has been stopped or reduced.

Cold ischemic time is the amount of time that an organ is chilled or cold and not receiving a blood supply. Following are some of the accepted cold ischemic times:

- Heart: 4 hours
- Lungs: 4-6 hours
- Liver: 6-10 hours
- Pancreas: 12-18 hours
- Intestines: 6-12 hours
- Kidneys: 24 hours (may go up to 72 hours if placed on a perfusion pump following recovery)

For transplantation after surgical removal of organs, it is important to be aware of the warm and cold ischemic times. These times have an impact on the long-term survivability and function of the organ in the recipient.

In brain dead organ recovery, the warm ischemia time is very less because virtually the organs are cooled at the same time that they are removed. In DCD organ recovery the warm ischemia time is more as the organs suffer before death of the donor, in the next 5 minutes after death of donor and till it begins to be perfused and cooled. \[45\]

There are 2 basic types of “donation following cardiac death (DCD)”, controlled and uncontrolled. \[46\]
In uncontrolled DCD the donor is a person in whom cardiac arrest was unexpected and from which the patient could not be resuscitated.

In controlled DCD, death of the patient occurs following planned withdrawal of life sustaining treatments which are considered to be of no benefit to the critically ill patient. The following are the clinical circumstances in which DCD can occur as described by the Modified Maastricht classification: (Table 2)

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
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<tbody>
<tr>
<td>I</td>
<td>Dead on arrival (uncontrolled)</td>
</tr>
<tr>
<td>II</td>
<td>Unsuccessful resuscitation (cardiopulmonary provided within 10 minutes of cardiac arrest) (uncontrolled)</td>
</tr>
<tr>
<td>III</td>
<td>Awaiting cardiac arrest (controlled)</td>
</tr>
<tr>
<td>IV</td>
<td>Cardiac arrest in a brain stem dead donor (controlled or uncontrolled)</td>
</tr>
<tr>
<td>V</td>
<td>Unexpected cardiac arrest in a critically ill patient (uncontrolled)</td>
</tr>
</tbody>
</table>

**Tissues and organs that may be donated and transplanted successfully in case of DCD**

Organs that are suitable to be transplanted in DCD are kidneys, liver, pancreas, lung and tissues such as cornea, bone, skin and heart valves etc. The entire body can also be donated to medical science for purpose of anatomical examination. Kidneys are the largest group of transplanted DCD organs. The 10 year success rate of DCD kidney transplant may be the same as that of a DBD. Compared to kidneys, livers transplanted following DCD have a have a poorer 1 to 3 year graft survival rate compared to DBD. Lungs are said to be organs that best tolerate absence of circulation provided that they remain inflated with oxygen. Whole pancreas can also be transplanted by DCD. [46]

Organs received from cardiac dead donors are associated with higher risk of non-function, poor early organ function and other such complications. Recent advances have led to more successes with non-heart beating cadaver organ donations and increase therefore in organ availability for transplant purposes. [44]

It is best to retrieve liver from a cardiac dead donor within less than 30 minutes, kidneys and pancreas within 60 minutes of withdrawal of life-sustaining measures. If the patient
does not die quickly enough to permit the organ retrieval, the planned organ donation is
cancelled. This is known to occur in 20% of the cases. \[42\]

**Ethical issues:**

Certain ethical issues are raised by DCD transplantation.

- In category II of Maastrict’s classification, attempts are made to resuscitate the
  patient. Failing this the transplant team arrives, cannulating the patient and starting
  the perfusion before the patient’s relatives can be contacted. Delay in cannulation of
  the patient till his or her end of life wishes are known, may mean that finally patient’s
  strongly held wish to be a donor may not be fulfilled. On the other hand, it could be
  considered as violation of potential donor’s autonomy to cannulate before knowing
  their wishes regarding organ donation.

- In case of category III donors, the treatment is being withdrawn from a living person,
  who will die because of the stoppage of treatment. This vital decision is taken on the
  basis of medical care professional’s judgment regarding extent of non-survivable
  injury in the patient, futility of further treatment and that any further treatment will
  not benefit the patient in any way. Standard recommendation to ensure ethical
  decisions in this regard is to keep the medical team treating the patient separate from
  and independent of the organ donation and transplant team. \[47\]

- Patients in case of DCD are not brain dead and could feel distress during the various
  efforts taken to obtain the organs \[47\]

- Doctors as well as nurses have expressed ethical dilemmas. Many medical care
  professionals are uncomfortable participating in medical practices required for
  transition from end-of-life care to organ donation. In an ICU medical care
  professionals care for both the potential organ donor as well as the potential recipient.
  Here they have to face conflicting interests, recommending the withdrawal of life-
  sustaining treatment for one patient and hoping to obtain organ for another. \[48\]

- The “dead donor rule” states that donation should not cause or hasten death and that
  organs be removed only from a patient who is dead.\[48\] This rule may prohibit
  interventions that might bring about death of the patient in order to retrieve a vital
  organ. Some have suggested that to meet requirements of this rule, patient should be
  wheeled into the operation theatre and both kidneys be retrieved. The death of the
  patient would then occur after withdrawal of life support measures and not the
  removal of the organs thus the “dead donor rule” would be satisfied. However this is
true only for kidneys whereas removal of other organs in a similar manner such as heart, liver or lungs would rapidly lead directly to death of the donor. The DBD is somewhat protected from the “dead donor rule” by the fact that brain death is an accepted form of death in many countries today. DCD which needs cardiac death before organ donation needs ethical guidelines.

Volk M et al states that majority of the DCD donors in USA are controlled (3, 4 Masstricht classification).\[^{46,49}\] This category of donor has low potential for growth as most controlled cardiac deaths involve elderly and persons with comorbidities that preclude solid organ donation. Thus uncontrolled DCD (1,2,5 Masstricht classification) has been recommended as an ethically accepted method to increase the number of organ donors. This means that it is recommended that organs should be retrieved from patients who were either dead on arrival at the hospital, or who were brain stem dead and went into cardiac arrest or were critically ill and went into unexpected cardiac arrest. But there were concerns about public support to organ donation after cardiac death, particularly about rapid organ recovery after sudden cardiac death. This was especially controversial as uncontrolled DCD involves insertion of catheters for organ preservation prior to family consent.\[^{49}\]

These concerns about public support for organ donation after cardiac death have hindered expansion of this practice, particularly rapid organ recovery in the context of uncontrolled (sudden) cardiac death (uDCD).

Volk M et al, conducted a national survey in USA regarding public support for organ donation after sudden cardiac death. It was observed that more number of participants supported organ donation after cardiac death (70%), (whether controlled or uncontrolled) than those supporting organ donation after brain death (66%). The authors suggest that this could be because of people’s discomfort about the concept of brain death. Thus the public may prefer organ donation after cardiac death as it resonates more closely with their popular concept of definition of death. The authors also noted some comments of mistrust in the medical system in DCD (uncontrolled) following which rapid organ retrieval was carried out. The authors suggest that all rules be followed meticulously with careful and strict separation of medical care team from transplant team. Many participants placed a caveat of consent from family members before inserting of catheters etc for organ preservation. Authors stated that obtaining family consent in situation of
sudden cardiac death places a logistical problem and thus it appears that uncontrolled DCD may be limited to those on the organ donation registry. .

**DCD in the world**

The rate of DCD has been increasing since 2005 when it was 7% to 2016 when it is 16%. There are some countries where it is even 30%. Some of the countries actively conducting DCD transplants are Czech Republic, Netherlands, Italy, France, United Kingdom, Spain etc. In fact in United Kingdom, the ratio of FBD to DCD was almost 2:1 by 2010. In 1995 USA saw 64 DCDs which has steadily risen over the years and in 2015 USA saw 1494 DCDs providing 2876 life saving organs. This was found to be 16.5% of the total donor pool. 

**DCD in India**

The introduction of non heart beating donor would have the greatest impact on cadaveric organ pool compared to cadaveric donations. 

Since the enactment of the transplantation act in India, the brain dead donor has been promoted as the primary source of organs. With increasing demand for organs for transplantation the non-heart beating donor can help meet the demand for organs. 

Bardale states that NHBD involves a lot of issues such as the time constraints, organ damage due to “warm ischaemia”, ethical and legal. 

Some ethical issues are as follows:

- To prevent warm ischaemia some centers may use in situ preservation which can lengthen the permissible period between the diagnosis of death and the organ retrieval from one hour to six hours.
- The patient might be put on artificial ventilation and cardiopulmonary bypass to preserve the organs, sometimes with and sometimes without the consent of the family.
- NHBD protocol advises use of heparin and pentolamine to prevent clotting and maintain vascular perfusion respectively while the donor patient is alive. Neither of these medicines are being given for the benefit of the patient and thus this action could be considered as a violation of the ethical responsibility towards the still alive patient.
- Some hospitals carry out cannulation of the patient to inject perfusion fluid for preservation of the organs. Such an intervention could lead to destabilization of the
cardiovascular system and precipitate death. Cannulation may be done only to inject medicines.

Both the above are invasive procedures done with or without patient’s and relative’s consent and may not be in the patient’s best interest. Such an act amounts to assault. The “dead donor” rule states that patient must be dead before retrieval of organs and that death should not be caused or hastened by the retrieval. \[^{52}\]

Though all centers agree on this premise, there are arguments about definition of death in NHBD programmes. Different centers advise different time periods (2 mins, 5 mins, 10 mins) after cessation of circulation and respiration, before retrieval of organs.

Bardale states that while in United Kingdom decision to withdraw treatment is made according to the guidelines given by Intensive Care Society, in India no such National guidelines are available. Such guidelines are needed and withdrawal of treatment should be done by the said protocol with prohibition of active euthanasia. \[^{52}\]

Bardale stressed on the fact that just as Dogra et al have formed guidelines for organ retrieval in brain stem death cases, there should be such guidelines for the NHBD programme as well. \[^{52, 53}\]

Nagral states that over last decade DCD has gained in acceptance despite their being several sensitive and complicated areas here dealing with end of life. Implementation of DCD programmes in India will not only need social and cultural acceptance but also strong regulatory mechanisms. Also essential will be trained medical teams who can conduct instant removal of organs as is the need of DCD. \[^{5}\]

Nagral goes on to say that there has been improvement in DBD activity over last 15 years following the Human Organ Transplant Act of 1994. The author himself has experienced almost a 40-50% consent rate from families of potential donors which is at par with many developed countries. He states that there is no reason that a family that consents to organ donation following brain death would not give consent to organ donation following cardiac death which is in fact a more understandable concept. He states that with patients dying regularly while on the waiting list, it would indeed be tempting to start a NHBD programme following the scientific and legal base provided by other nations already carrying out DCD programmes successfully. However considering the complex moral, social, ethical and legal issues involved, he wonders if the unregulated Indian medical care system is ready for it? \[^{5}\]
3.4 Live organ donor and Live organ donation

The first successful living organ donation and transplant was carried out in 1954 when Murray and his team successfully transplanted a kidney from a young man and implanted it into his identical twin. Since then all over the world living donor transplants were the norm. With the advent of immunosuppressive drugs organs from unrelated donors began to get transplanted and the pool of potential living donors expanded. Later the organs for transplant were also obtained from patients declared dead by circulatory criteria. In 1968 when the Harvard committee stated the criteria for brain death, the new category of brain dead donor (neurologic criteria) was introduced.\textsuperscript{[28]} (Table 1)

Live organ donation is a type of organ donation wherein the donor is alive. This can only be done if the person who donates can still live healthily after donation of the organ. Living donation can be of regenerative tissue (bone marrow, blood, liver) which can grow back after the donation or non regenerative tissue (kidney) which can never grow back after being donated. Kidney is the most common of live organ donations. This is because a person has 2 kidneys and normal filtration needs of the human body are met by one kidney. Part of the liver also can be donated. The donated part soon grows back within the donor.\textsuperscript{[54]}

Thus living donors can potentially donate one of the 2 kidneys, one of the two lobes of liver, a lung or a part of the lung, part of pancreas and part of intestine.\textsuperscript{[2]} Recently in Pune Revenue division live donor uterus transplants were carried out.\textsuperscript{[55]}

Except liver all the rest of the organs do not regenerate. However the parts donated and the parts left in the live donor are able to serve the function of the respective bodies adequately.\textsuperscript{[56]}

The living donors have also been known to donate skin after abdominal surgeries, bone after knee or hip replacement, bone marrow, blood etc. (these are not dealt with in present Thesis)

\textbf{Advantages of live organ donation:}\textsuperscript{[57]}

When the donor is a living donor, the transplantation outcomes have been known to be better. The patients waiting time is much reduced and surgeries can be planned well. In case of a DBD or a DCD the surgery is always sudden as it depends upon the donor becoming available. This form of donation also increases the chances of those patients who have no available living donors of getting donated organs from available pool of DBD and DCD.
A person in good general health, physically and mentally and above age of 18 years and usually not more than 60 years, can be living organ donor. [54]

Many medical conditions are contraindicated for being a donor as such medical conditions could have already damaged the organ to be donated or could cause damage to the recipient later after the transplant. [58] Absolute Contraindications to organ donation are age above 85 years, any cancer with proof of spread outside the affected organ within 3 years of organ donation, melanoma, active hematological malignancy, choriocarcinoma, active, untreated tuberculosis and HIV infection. Others include hypertension, diabetes etc. Some contraindications are specific to the organ being donated and transplanted. In case of liver transplant they are hepatitis, portal vein thrombosis and cirrhosis of liver. In case of kidney transplant they are chronic kidney disease and previous kidney transplant greater than 6 months previously. In case of pancreas being transplanted, insulin dependent diabetes, history of pancreatic malignancy is contraindication. In case of heart transplant, age greater than 65 and documented history of coronary artery disease is the contraindication. Transplant of lung is contraindicated if age of donor is greater than 65 years, if there is any history of intrathoracic malignancy or history of any other major lung disorder. [59]

There are some prerequisites for live organ donation. The living donor must be informed about the process of live organ donation and the known risks involved. He or she must go through complete medical and psychosocial evaluation before taking the decision. He or she must be evaluated for any pressure pushing the person to be a donor. [59]

**Risks to the donor in live organ donation**: [60]

The donor may experience physical as well as psychological risks during and after the organ donation surgery.

Since live organ donation is a surgical procedure all complications related to major surgery apply to this surgery as well. In fact in live organ donation, the donor bears almost the entire risk of major surgery for another person’s medical benefit and any psychosocial benefits to himself or herself as a secondary benefit resulting from donating an organ to someone in need. [57] The recipient meanwhile is the primary beneficiary. His or her time waiting for the organ to become available is reduced and he or she enjoys improved health and quality of life post transplant. The surgical risks include pain, infection at site of surgery, incisional hernia, pneumonia, bleeding, complications related to anesthesia and death.
The donor may also experience some psychological symptoms following the surgery. Possibility of change in relationship between donor and recipient may also occur. Some undiscussed but observed negative consequences of live organ donation are delay in returning to work due to lingering health issues due to postsurgical complications. There may be difficulties in obtaining the relevant insurance amount. Financial burden resulting from above should be thought of beforehand prior to decision to be a donor. It should not come as a shock to the donor and act as a deterrent to other live organ donors. In fact in USA, a solid organ donor is allowed 30 days of paid leave post organ donation. Also some countries have programs that grant reimbursement for travel and subsistence expenses and incidental nonmedical expenses incurred by living organ donors. The transplant team as well as Hospital staff and social workers are best sources of information about the risks. However it is also equally important that the donor take active interest in learning more about the potential short term and long term complications after being a live organ donor.

**Types of living organ donors:**

**Directed donation:**

Most of the time the living donor is a person who is a near relative of the recipient. Such an organ donation between relatives or friends is called as directed organ donation. In directed donation, the donor directly names the person to whom he or she wishes to donate or who will be the recipient of the organ being donated. This is the most common type of living organ donation. The donor in directed living organ donation may be any of the following:

- A biological relative such as brother, sister, father, mother, aunt, uncle, grandparent etc
- A biologically unrelated person such as spouse, close friend
- A person who has heard about the patient’s plight and comes forward to be the donor.

In different countries eligibility of live donors is different and depends upon the Law of that country. In India the live donor can be a near relative such as brother, sister, mother, father, son, daughter, grandparents, grandchildren or if he/she can be the spouse of the recipient or person having great affection “friend” of the recipient.
**Paired donation:**
When 2 pairs of living kidney donor and recipients are ready but do not have matching blood types, then the donors are exchanged and each recipient receives the organ (kidney) from the donor from the opposite pair who is of the compatible blood type. Sometimes there may be more than a pair of donors and recipients involved. In this situation it is called as the “domino paired exchange”. [61]

**Non Directed or Altruistic donation:**
Living organ donation can also be non directed. This is comparatively rare. Here the living donor is not related to or known by the recipient. But he or she makes the donation purely out of selfless motives. Such a live donation is not allowed under the Indian THO Act. [11] The donor has no say in who may or may not receive the donated organ. The match is made on the basis of medical compatibility with a patient in need. Care is taken to preserve the anonymity of the donor and recipient. In some cases they may decide to meet if the transplant center policy permits it. [54]

**A new arrangement:**
This form of live organ donation is between the directed and non directed donation. Here the living unrelated donor donates to a pool of transplantable kidneys, with the expectation that the donor’s loved one will receive priority for a kidney from a deceased donor. He or she is unable to directly donate the kidney to their loved one due to blood type or cross-match incompatibility. Thus he or she provides a kidney to the system which in turn provides a kidney to the recipient who is a loved one of the original donor. Each of the above donor-recipient relationships raises a number of ethical issues.

**Ethics of Live organ donation:** [54]
The very concept of living organ donation seems to violate the traditional first rule of medicine “primum non nocere” i.e. above all do no harm. This process itself involves the removal of a healthy organ from a healthy person for implantation into another person. It must therefore be guided by certain basic principles:

**Principles:**
There are certain principals which form the pillars of live organ donation. These must be followed if every living donation is to be ethically acceptable. They are as follows:
- Living donation must be altruistic. The donation of the organ should be done with no expectation of rewards
• The decision to donate must be taken of their own free will by the living donor. It should be free and voluntary. It should not be under the influence of emotional pressures of fear.

• The decision should be an informed decision. The living donor as well as the recipient must be fully informed about the possible risks during and after the donation procedure.

• All involved in the process of decision making must be treated with respect and care whether the donation goes ahead of not. All should work towards the best possible result for both the donor as well as the recipient.

• Decision of organ donation is a process influenced by cultural beliefs. All involved must consider and be sensitive to the cultural beliefs as well as the language of the involved persons while giving related information.

Living donation involves a lot of ethical questions. This is true because here a healthy person undergoes a surgery that does not benefit his or her body and may even harm them. Greater the risk of harm to the donor, greater is the ethical concern.

Thus some **ethical standards** must be met before the living organ donation can go ahead:

[62]

• Acceptable risk-benefit ratio is the 1st precondition

• The donor must understand and accept the risk to themselves

• There must be very low chance of harm to the donor’s physical or mental health (short term as well as long term)

• There must be very high chance of the transplant surgery being successful

• The wellbeing of the donor is to be considered above that of the recipient

• In case the potential donor is a child or a dependant adult, an independent team must decide whether the donation would be in the child’s or dependant adult’s best interests. These are people who are very vulnerable and must be protected. Children and dependant adults (in case of mental illness, brain injury or dementia) are incapable of deciding to be living donors. Yet they may be the only good match for the transplant. In such situations the health care team of the hospital should help the family to come to the best decision which takes into account the welfare of the donor as well as the recipient. It is possible that the potential donor may suffer more from the loss of the potential recipient than from undergoing the surgery itself. Both the
above vulnerable populations must be made aware of all their options and (if capable) be involved in the decision making process. [54]

**Continuing care of the donor:**
All donors must be offered medical and mental care for at least one year after the donation and longer in case of complications.

**Live organ donations are often said to be ethically problematic:** [57]
Following are some of the ethical issues that have to be dealt with during a live organ donation:

i. **Possibility of pressure on the living related organ donor:**
The living related donor is often genetically related to the recipient. Duties and obligations and emotional bonds, related to a relationship often weigh heavily on the decision to donate. Here there is always a possibility of undue influence and emotional pressure and coercion. Voluntariness of the of the prospective donor’s decision is affected by the potential benefits to the donor and his or her family which is also the potential donor’s family. Thus the potential donor’s bodily interests may be in conflict with the potential recipient’s bodily interests.

There is a need here for a donor advocate who may evaluate the donor confidentially, with attention to their willingness to be donors. [63] In USA, all transplant hospitals are required to have a living donor advocate or a related team. This team or individual screens the potential donors, to check if they really understand the risks and benefits of proposed live organ donation and if they are capable of looking after their own safety and welfare. They discuss the motives and the expectations of the potential donors in consenting to become live donors. Through this process they try to discover any overt or subtle forms of coercion existing in the family. The potential donor may feel trapped in a situation wherein not consenting to be an organ donor may jeopardize his or her relationships within the family. The potential donor should feel free to discuss the procedure, any ethical or personal safety concerns, any pressurizing from within the family or any other doubts with the donor advocate. [64]

There transplantation team or the donor advocate may sometimes find it justifiable to offer a medical excuse to enable the pressurized donor to escape the unwanted organ donation and yet manage to save relationships within family.
ii. Gender imbalance in live organ donation:
There has been a noticeable gender imbalance in living renal organ donation. The incidence of women donating kidney is significantly higher than that of men. Women constitute 56-59% of living kidney donors every year.\[57\]
This could be because women are more vulnerable to subtle pressures.\[65\] The author states that times have come when we need to stop appreciating women for their altruism and to start investigating into this gender imbalance. It is time to check for matters of fairness and undue pressure on this vulnerable group.
Living organ donation has been on the rise. But with a rise in this category of transplants, the gender imbalance has also seen a steady rise. It has been observed that 36% of the wives who were acceptable for donation did donate compared to 6.5% of the husbands.

Some gender specific observations in relation to live organ donation\[66\]
- Women seem to have more self-sacrifice and sense of responsibility compared to men.
- Women are more predisposed to donate their organs
- Two-third of all organs is donated by women.
- The gender disparity in living donor transplantation is because of higher proportions of wife to husband donations.
- This is also observed because of disproportionate female to male donations among biological relatives and also unrelated pairs.
- A study suggested that men and women donate roughly by the same rate when asked to become organ donors, but women are asked more often, hence the higher incidence of female donors.
- Women are less predisposed to accept transplant surgery
- The number of female transplant recipients continues to decline
- One of the reasons suggested for the above differences is disparity of knowledge about transplant and its outcomes, among the women.
- Men have higher incidence of end-stage diseases that necessitate a transplant
- Men are more predisposed to hypertension and ischemic heart disease making them poor potential donors.

Impact of sex of the donor on organ transplantation: \[66\]
- In renal transplantation, female donor kidneys have a worse 5 year survival.
Female kidneys have less number of nephrons compared to males

- Kidneys of females have been found to express more HLA antigens and are more antigenic
- The male grafts are less susceptible to nephrotoxic effects of immunosuppressant drugs compared to female grafts
- Male recipients have a worse survival compared to female recipients.
- It is possible that the protection afforded by the hormones in females could result in their better long-term prognosis.
- The impact of sex mismatch in a transplant is still under debate.
- In case of heart transplant, there has been a observation that donor-recipient sex mismatch could be undesirable in males as well as in females.

iii. Live organ donation has to be donation and not sale.

In case of living unrelated donor, the ethical concerns are focused on the possibility of buying and selling of organs. Solicitation of a living donor is an area of concern and discussion after widely publicized cases of solicitation of organs through newspapers, billboards and internet. [67] Money may be a factor in live related donations as well. Compensation of donated organs is illegal in most countries. The law in USA states that “it is unlawful to knowingly acquire, receive or otherwise transfer any human organ for valuable consideration”. [68] In most other countries the Law supports the above statement. But permitting a market for organs could be an efficient way to achieve an increase in supply of organs. Following this principle, the Iran government has legalized payment to their kidney donors and this payment is done by the Government of Iran. Today it is one of the countries with fewest people on the waiting list for transplants. [69]

However such compensation of live donors opens up the possibility of exploiting of the poor and the underprivileged people. In fact the international market in organs from living individuals appears to involve the exploitation of poor people and of the desperately sick patient, who is inadequately informed, whose consent has been manipulated with adverse consequences to both the buyer and the seller of the organ. [69]

In this kind of money transaction, there is also a possibility of the potential donor not divulging a serious medical condition for the monetary benefit.
iv. **In case of a living unrelated donor**, there are also no genetic ties to the recipient though there could be emotional bonds. The issue of pressure exists here too especially when the person is a spouse of the recipient.

v. **Risk-benefit ratio inadequately explained** [71]

Here the risk to the donor is balanced against the benefit to the recipient and also to the donor. The ratio has to be explained and understood in terms of probability and magnitude of the harm.

Live organ donation developed on ad hoc basis at various transplant centers. It has never had a central supervision that has been a part of deceased organ donation activity. Thus there is lack of information as well as accountability as seen in deceased donor programs. It is important to register each living organ donor, to specify the parameters to be followed up over the years. Some of the data to be collected includes physical and mental health of the donor, financial resources, insurance status and experience etc. [57]

Usually the information to the potential donor is inevitably inadequate as often the long term health outcome of the particular type of live organ donation is only beginning to be explored. This is especially true in case of non renal live organ donations.

Another reason for inadequate information being provided to the potential donor is that the data for such situations has not been collected and analyzed rigorously. There is little long term follow up of donors to study physical and psychosocial effects of living organ donation. For those who have donated liver or lung there is hardly any data available as only recent and short-term studies are available and very little is known about the long term effects of these organ donations.
3.5 Human Organ Trade

To trade is to transfer ownership of goods from one person to another in exchange for remuneration. Organ trade is the trade of human organs for the purpose of transplantation. Shortage of transplantable organs has created a severe deficiency of organs and resulted in a thriving global organ market. This organ trade is considered illegal almost all over the world with a few exceptions.\[72\]

Some of the countries suspected or known to have conducted organ trade are Brazil, Canada, China, Colombia, Eastern Europe, India, Pakistan, Russia, United Kingdom and USA.

Illegal organ trade is said to generate profits between $600 million to $1.2 billion per year. Some of the ways this trade is carried out is by taking advantage of poverty and influencing the poor to sell their organs for a price. Kidnapping of people, murder and selling of organs has been reported.\[72\] Sometimes loopholes in the Law have also resulted in continuation of organ trade.\[33\] Recently the use of injured soldiers as well as prisoners for obtaining and selling of organs to fund the ISIS activities has been reported.\[73\] It is estimated that 42% of transplanted organs come from organ trade. Scott Carney coined the term “Red Market” for the various monetary transactions related to human body trade.\[74\]

Some countries have officially legalized payment of their donors. These include Iran, Australia and Singapore.\[72\]

Iran

Iran had made it legal to pay their kidney donors. It is said to be the only country which has no waiting lists for kidney transplant. The whole process is regulated by 2 charitable organizations namely Charity Association for support of kidney patients and Charity Foundation for Special Diseases. The renal transplant physicians explain to the patient the advantages of living donor transplants and also the scarcity of deceased donors. The potential recipients are encouraged to wait for 6 months for a cadaver donor. Thereafter if they cannot get a living related donor they are referred to the Dialysis and Transplant patients Association (DATPA). Any potential donors are also referred by all concerned to DATPA.\[69\]

The transplant team does not receive any incentive for carrying out the transplant. A foreigner cannot be a recipient of kidney from a living unrelated donor in Iran. Foreigners are also not permitted to volunteer as donors to Iranian patients.
A living unrelated donor will receive an award (about $1200) and health insurance from the government. The living unrelated donor may also receive a separate reward from the recipient. The government and insurance of the recipient cover also the cost of renal transplantation. Immunosuppressive drugs are also provided by the Government of Iran. The donors must be of the same nationality as the recipient, must be aged between 20 and 35 years, must be healthy and should have consent from spouse or parent. Advertising for living donation is banned, but there is a surplus of living donors. The supply is greater than demand here. It has been observed that almost all the living unrelated donors are very poor. The donor also faces social stigma, as it is considered shameful and wrong to sell your kidney. Also women here are more likely to be donors than recipients especially if they are unemployed. They are also less likely to find their names on the waiting list. The system of paying their unrelated donors has legalized the money transaction involved in unrelated donor and at the same time has discouraged the deceased donor program in Iran. Hence in Iran only 12% of kidney transplants are from a deceased donor kidney versus 65% in USA. With so many ready unrelated donors available, deceased donor program may not take off well here. \[69, 75\] In a study of 100 donors in Iran, 76% of donors felt that kidney sales should be banned and that given another chance they would have preferred to beg or borrow money than sell their kidney. Those who cannot afford to pay for organs have to stay on dialysis and on the waiting list for cadaver donor. A recipient of cadaveric kidney need not pay for the surgery or the kidney and are probably the poorest of the patients. Though it is said that Iran has eliminated its waiting list for kidneys, this is not true. The waiting list exists for the cadaveric organs. Today many transplant experts believe that providing financial incentives to donors needs to be carefully considered. They laud the 1988 Iran model, which has avoided many ethical problems associated with organ trade. \[69\]

Other countries that have also legalized sale of human organs are Australia and Singapore.

**Australia:**

While clearly stating that Australia would never adopt a policy of cash for organs, Health Minister of Australia stated that individuals who wanted to donate a kidney would be offered six weeks paid leave at a wage up to 3600$. This was being done as a part of the
Federal government’s plan to reduce the persons on the waiting list. The view of the government was that a number of people could not afford to take 6 weeks off to carry out the good deed of organ donation for a family member or an unknown person. This would reduce the financial burden on the donor. This move was said to be a step towards reducing the gap between donors and recipients. [76]

**Singapore:**

The waiting time for an organ from a cadaver differs from country to country. In Singapore it is 6 to 8 years. [77] To counter this problem, in 2008 Singapore decided to legalize payment of kidney donors. This move reignited the debate about how to respond to global shortage of transplantable organs. The reform came into being following a number of high profile convictions for attempted sale and purchase of human organs in Singapore. [78] Singaporean authorities however clearly stated that reimbursement of costs and losses incurred by the donor should not be construed as payment for the donated organ.

While above payment for organs is legalized by the respective countries, organs are being obtained by organ trafficking which has been defined by the Declaration of Istanbul as a method of coercion, abduction, fraud, deception, abuse of power or of position of vulnerability, of giving or receiving of money to gain control over a donor, for purpose of exploitation by removal of organs for transplantation. This involves not only organ trafficking but also trafficking of humans for purpose of obtaining organs. [79]

In 2007 World Health Organization commented that organ sales from commercial living donors or vendors accounted for 5-10% of annual kidney transplants performed around the world. [80]

There have been reports of organ trade from different parts of the world.

**China:**

The practice of organ harvesting from prisoners was first authorized in China in 1984 when their Government enacted a special law authorizing it. Over the following years it was thought that executed prisoners are the main source of organs and tissues in China. China was not only using these organs which were obtained at times while the donor was still alive for transplants within China but was also selling the same in black market. Despite this China was suffering from shortage of organs for transplants. The Kilgour and Matas report in 2006 states that China has conducted 41,500 transplants over period of 6 years between 2000 and 2005. 98% of organs for transplant in China come from non
family donors and Chinese nationals are reluctant to be organ donors even after their death for cultural reasons.\(^{(81)}\) So there is no organized system of organ donation in China. They also state that the number of executions in China is much more than the number made available in the public domain. The Falun Gong practitioners are another alleged source of organs used by China. The family members of Falun Gong practitioners state finding of surgical incisions on the corpses of their loved ones with organs missing. The Government of China has reduced the funding to the health system which is majorly funded by organ transplants. The military has also been given green light to raise money privately and are heavily involved in organ transplants to raise money for itself. Waiting time for transplants in China are therefore very short almost a matter of days.\(^{(72, 81)}\)

The poor in some villages in Indonesia have reported to have sold their kidneys for 7500$. Agents go to villages, convincing the poor about health aspect of kidney donation. The lure of money is usually too much for the poor who agree to sell their kidneys. The amount paid by the recipient is as much as 30000$ out of which the actual donor receives a very paltry amount. When enquiries were made into the health status of the donor, it was found that he or she was feeling weak. Their quality of life had deteriorated. Their monthly earning had reduced. The money they had obtained by sale of kidneys was spent or frittered over silly expenses and the family was back to living below poverty line but in worse condition than before.\(^{(82)}\)

**Transplant Tourism**

When a potential recipient travels long distances, crossing international borders with the purpose of undergoing an organ transplantation surgery, the activity is referred to as “transplant tourism”. Here patient is said to have obtained the organ through organ trade or by means beyond the regulatory frameworks of their countries of origin.

This is a large industry. There are websites that offer “transplant packages” for variable amounts for each type of transplant surgery. There are “facilitators” from the recipient’s countries of origin who will contact and facilitate the deal. There are international agents who arrange the travel. There are agents who recruit the donors from villages and remote areas, convincing them to become donate organs.

Governments can chose to trade health services to achieve their national health objectives under the General agreement of Trade in Service (GATS) law. Hence countries themselves use this transplant tourism to boost their own economy.
Thus “transplant tourism” is a above board appearing activity. However when it occurs in countries where there is no regulatory framework to protect the live organ donors from various forms of pressure it raises ethical concerns.

There are syndicates which arrange for travel of not only the recipient but also the donor to a third country. Not every donor travels to this third country of his/her free will!

In the world of transplant tourism the countries get classified as “organ exporting” and “organ importing” countries. The organ exporting countries include India, Pakistan, Nepal, China, Egypt, Brazil, Iraq etc. These are countries where organs from local donors are regularly transplanted into foreigners through sale and purchase. With enactment of new stringent transplant laws the picture is changing in some of these countries, including India. The organ importing countries are countries whose citizens regularly travel abroad to undergo transplant surgeries. These countries include USA, UK, Israel etc.

If the recipients are getting the necessary transplant surgeries, the host country’s economy is thriving and donors are coming forward to donate organs, why is this activity being looked at as being suspect?

This is because there are negative reports about these transplant tourism surgeries. The donors may be forced, fraudulently brought in or cheated into donating their organs. Because of poor screening of the donors, the organ being transplanted may itself be of poor quality. Thus the patient and graft survival rates after these surgeries have been found to be low. There are reports of transmission of HIV, hepatitis B and C. Some patients, who were refused surgery in their own country due to some medical complication, were operated upon in countries running transplant tourism centers. Here there is exploitation of not only the donor but also the very sick recipient whose illness itself makes him/her a vulnerable population. There is no apparent follow up on the health status of the donor. [84]

**India**

India had a busy organ transplant market before the THO act was enacted in 1994. [11] Patients from all over the world were getting kidney transplants done in India and India was considered as one of the largest kidney transplant centers in the world. However with the successful programme came some problems. People began to complain of their kidneys being removed without their consent, or nonpayment of the amount promised before kidney retrieval and so on.
Such unethical activities led to Indian government enacting the THO (Transplants of Human Organs) Act 1994. [11] This act was laid down to promote deceased organ donation and discourage live organ donations unless they were by near-relatives. However loopholes left in THO Act inadvertently or intentionally have resulted in continuation of Indian organ trade within the realms of the Law. THO act has a provision for live organ donation by a third person who is not a near relative who is able to establish and prove great “affection” for the recipient. [33]

Occasional news of organ trade is still reported in India.[85, 86] In such organ trade rackets there is usually a local agent who establishes a contact within the transplant approved hospital staff, convincing this person to get the false documents approved through the hospital committee in exchange for some money. In such situations, there are several supporting people involved as well such as one person who specializes in producing the fake documents. Thus a racket is run with a kingpin who has contacts with ‘contact’ within the transplant approved hospital, person who can produce the fake documents, person/ persons in different small towns and villages convincing the poor to appear in front of the hospital committees in the false role of ‘near relative’ and sell their organs for a ‘said’ amount. At times false marriage certificates are produced to fit into the “spouse” category of live donor.

Such rackets are symptoms of deeper malaise that ails the healthcare sector. It is because the cadaver donor programme has not taken off as it should. It is felt that there is a need for the health Department of the State to make it easy for family members to donate organs of the deceased kin, employ more counselors to spread awareness about organ donation and to work closely with the Hospitals to understand and tackle the problems they encounter during organ donation. With effective implementation of the cadaver donor programme, more and more donors will donate organs reducing the need for people to get transplants through such rackets.
3.6 Expanding the donor pool: Use of marginal donors, and others

Organ transplant has become the treatment of choice for increasing number of patients suffering from irreversible organ failure. In response to this increased demand, there has been an increase in the number of transplant centers almost all over the world. However there has also been a simultaneous increase in the number of patients on the waiting list for transplant. There has also been a gradual decline in traumatic deaths of potential young donors. Organ donation has been unable to keep pace with the demand for organs. Thus every year patients on waiting list die while awaiting an organ to become available for transplant. \[87\]

Hence there is need to expand the donor pool by using the “marginal donors”. This is a broadened criterion for acceptable donor organs. These have lesser graft survival rates compared to ideal donor organs. However use of these higher risk organs result in lifesaving transplants and survival of many patients who otherwise could have died on the waiting list. \[87\]

Following are some types of marginal donors: \[88\]

1. **Complex living donor**
2. **Non heart beating donor**
3. **Marginal cadaveric donor**

**1. Complex living donor: (Living donor)**

This person is a living donor. He or she is a suboptimal donor who has an associated disease condition and is called as a **complex living donor**. On the basis of the disease condition, the complex living donors are further categorized on the basis of certain risk factors existing in them:

- Evidence of current renal disease (Haematuria, proteinuria, nephrolithiasis)
- Direct risk of chronic renal disease (Hypertension, obesity)
- Decreased size of nephron mass (Age ≥ 65 years)
- Genetic risk factor (Family history of end stage renal disease in 1st degree relative)
- Risk factors for chronic kidney disease (Diabetes in 1st degree relative with impaired fasting glucose)
- Cardiovascular risk factors (Smoking, hyperlipidemia, hypertension)
- Combination of above factors
While the organ being donated by the above category of donors may be suboptimal and affect the donor outcomes, there is also potential for harm to the donor.

The influence of donor age on the outcome of living donor kidney transplant is not clear. A study by Kumar et al, compared long term outcomes of recipients with elderly living related donors with recipients with younger donors and found no differences in graft and patient survival between the 2 groups at the end of 1 year and 5 years. [89] Kumar et al concluded that in the view of acute donor shortage, if properly screened, elderly kidneys could be used without increasing the risk to donor or compromising graft outcome.

In case of hypertensive donor, Townsend et al stated that short term studies suggest no increase in the incidence of kidney disease in donors with history of hypertension. [90] There is lack of data on living donors with nephrolithiasis. Hence there is a reluctance to accept living donors with nephrolithiasis for kidney donation. But there are reports of transplant of kidneys with renal stones. Harraz and Shokein state that a donor with history of stones is suitable for donation if he or she does not have any risk factors that predict recurrent stone formation. If the donor has a kidney stone, he or she can be accepted for donation if the stone is less than 1.5 cm and if it can be removed during transplantation. It is not known if a donor with kidney stones has worse outcome than those with two kidneys, however after the donation the remaining kidney needs to be carefully monitored. [91]

Obesity has been defined as BMI ≥ 30 Kg/m². An obese donor with BMI of 35 Kg/m² without any other comorbidity is acceptable for becoming a donor, though patient is encouraged to lose weight prior to surgery. [88]

Presently, malignancy is a contraindication for organ donation. However a donor with prior history of malignancy may be accepted if the disease did not result in decreased renal function, and if it was cured and is not potentially transmissible. However both the donor and recipient should be made aware of the fact that transmission of malignancy cannot be completely excluded. [88]

In case of donors with transmissible infections, donors with Hepatitis C virus have donated to a hepatitis C virus positive patient. In such cases there should be careful follow up of the donor and recipient in the outpatient clinic, to detect worsening of liver disease. [94]

All the above and many more constitute the complex living donor. While there are many ethical issues wherever a living donor is involved, in case of complex living donor, these
issues are even more. The medical professionals must follow the principle of non-maleficience, which is to do no harm. This principle itself is threatened by the present scenario wherein a living donor undergoes a surgical procedure with a gamut of risks, voluntarily with no personal benefit. The ethical issue is multiplied further here in case of complex living donor as the donor has a medical condition further compromising the health of donor as well as the recipient. The judgment of organ donation in this situation is taken on the basis of available medical information about the magnitude of the potential risk to both. [88]

The possible solutions to above created dilemma could be:

- Compulsory use of donor advocate teams
- Encouraging the potential donor to speak to the former donors to discuss their experiences.
- Strict follow up to be maintained for all donors to make data available for more reliable judgment of risk-benefit ratio
- Long term follow up care of donors

2. **Non heart beating donor**: *(Cardiac dead donor)*

This has been discussed under donation following cardiac death (DCD).

3. **Marginal cadaveric donor**: *(Deceased donor)*

A marginal cadaver donor is a person who at the time of death is aged 60 years or above or is 50 to 59 years of age with any two of the following criteria:

- Pre-existing history of systemic hypertension
- Terminal serum creatinine >1.5 mg/dl
- Cause of death is cerebrovascular accident

The concept of marginal cadaver donor was raised to address the increased demand for organs for transplant. The marginal cadaveric donor is also referred to as the expanded criteria donor (ECD).[24]

Sometimes the function from a single marginal cadaver donor kidney may not be sufficient for the filtration function of kidney. In such a situation a pair of kidneys with limited function may be transplanted in one individual. This is called as a **dual kidney transplant**. This option offers kidney function which is almost as good as a single kidney transplant with normal function. This also helps to meet the increased demand and severe shortage of organs for transplant. The decision of accepting the ECD organ is that of the
recipient. Accepting the organ may reduce the amount of time patient spends on the waiting list waiting for an SCD organ to become available.

Studies have been conducted to analyze the effect of use of ECD kidneys and the authors concluded that the long-term survival of single or dual kidney grafts from donors older than 60 years of age is excellent, provided the grafts are evaluated histologically before implantation. \[93\]

The Eurotransplant Senior Programme (ESP) began in 1999 with the aim of achieving a more efficient use of kidneys from the elderly donors and offering transplantation into elderly patients.\[94\]

A kidney graft that outlives the patient is said to be a success. Thus a slightly suboptimal graft has a better chance of surviving an older than a younger recipient. This was a way of allocation of organ by matching the metabolic demand of the recipient with the excretory capacity of the donor organ. To guarantee an acceptable degree of success, it was decided that such kidneys would be transplanted with least possible cold ischemia time. There was an option of transplanting both the kidneys in the same recipient in cases in which the donor creatinine clearance was < 70ml/min.

It is estimated that at the end of 1 year, 8 out of 10 ECD kidneys will be functioning compared to 9 out of 10 SCD kidneys. At the end of 5 years half the ECD kidneys will be functioning compared to 7 out of 10 standard cadaver donor (SCD) kidneys. It has been proved that patients who receive either SCD or ECD kidneys have superior survival compared to those patients who remain on dialysis. \[95\]

**Extended criteria donors in Liver transplantation:**

Mortality in case of patients on waiting list for liver transplant is even more than that in cases of kidney transplant because while kidney failure can be supported by dialysis, liver failure has no such alternative. Also while every deceased donor makes two kidneys available in the donor pool, the number of livers contributed by one donor is still single. Hence transplant centers had to think of ways of increasing the number of grafts available by accepting marginal liver donors who were earlier considered as inadequate due to higher risk of initial poor function, of graft failure or of disease transmission. \[96\]

Some **marginal donors** used in liver transplant are

- Elderly donors
- Steatotic graft (fatty liver)
- Non heart beating donors (DCD)
• Hepatitis C virus positive donor
• Hepatitis B core antibody positive donors

Although above category of donors were rarely used earlier, today the use of marginal liver grafts has increased significantly. Hence the transplant community has stated rationales that need to be used to maintain excellent results in these liver transplantations. It is necessary to recognize the donor group by the quality and to match it to the correct recipient on the basis of new organ allocation policies for marginal grafts.

Tector et al state that liver grafts from ECD can be used to dramatically reduce waiting list time with outcomes similar to SCD without any necessity for a living liver donor. However their study found that donor age above 60 in an ECD and the cold ischemia time greater than 12 hours, was associated with increased incidence of poor graft function and patient survival. Hence all ECD cases should be closely monitored and analyzed to reassess donor boundaries on the basis of the experiences.

Roach states that while living liver donor increases the number of livers available for pediatric and adult recipients, donor safety is a major concern. The procedure involves serious donor morbidity and mortality. All ethical concerns related to a live donor apply here as well. However with growing experience, the living liver donor surgery also has become successful. However demand for a liver allograft still cannot match the supply.

Split Liver Transplant:

Split liver transplant surgery is being perceived as an important strategy to meet the demand for livers for transplant. This surgery creates 2 transplant grafts from 1 allograft. A smaller allograft is created from the left lateral segment of liver. This is used for a pediatric patient. The right extended liver lobe graft can be used for an adult recipient.

Out of the 25 split liver recipients and 121 whole liver recipients, the split liver recipients had a 80% 5 year survival rate while the whole liver recipients had an 81.5% survival rate for the same period.

Expanding the pool of donors further:

• ABO incompatible donor

Kidney transplant from an ABO incompatible donor is another attempt to increase the donor pool. Transplant using an organ from an ABO incompatible donor is more expensive and requires a longer stay of recipient in the hospital. It however still turns
out to be more cost effective compared to dialysis. This type of kidney transplant has been performed for almost 50 years now with satisfactory results.\(^{[100]}\)

**Death row prisoners**

**Badrolhisam and Zakaria** studied the knowledge, religious beliefs and perception towards organ donation from death row prisoners from point of view of patients and non-patients.\(^{[101]}\)

Many countries have obtained organs for transplant by using the executed prisoners as organ donors. In China according to Branigan, 2\(^{rd}\) of organ donors are executed prisoners.\(^{[102]}\) According to Chao and Sommers, 90% of executed prisoners’ organs have been used in organ transplants.\(^{[103]}\) Today people travel to China for organ transplants. Singapore has legalized donation of organs by death row prisoners and Taiwan too has this practice since 1990. Philippines has program in which the prisoners are allowed to exchange their death sentence for kidney donation to any organ transplant organization\(^{[104]}\)

This practice has a lot of pros and cons. The cons against death row prisoners as donors is that the chemicals used for execution could damage the organs. Some consider it as a form of coercion. Even if a prisoners agrees to donate it is not considered as an act of free will.\(^{[105]}\) Some feel that prisoners could be subjected to force, fear or pressure to agree and this is unethical. Such a practice could lead to commercialization of organ transplant. There is a fear that the prisoners may be executed before their time to access the organs. Some believe that such prisoners do not deserve to contribute to the society.

**Badrolhisam and Zakaria** studying attitudes of patients and non-patients towards receiving organs from death row prisoners found that 32.4% non-patients and 8.5% patients were ready to receive organs from death row prisoners. 20.7% of people from both categories were not ready to receive such organs. 26.8% were keen to know the type of crime committed by the prisoner in case they decided to accept the organ.\(^{[101]}\)

**Fetus as organ donors:**

It was proposed that the donor pool could be increased by using organs from aborted fetuses. This tissue has its own special benefits as it can be used in children; it is not readily rejected and can grow. However there are ethical arguments to this issue as there is concern that this would create a branch of biomedicine which was dependant on continuation of abortion of fetuses. Availability of this option might neglect other
possible research in this field. Also abortions could be planned as per need of the recipient instead of the mother. It also implies complicity of the medical personnel in the process of abortion. [106]

- **Anencephalic babies as organ donors:**

  Ahmad discussed the use of anencephalic babies as potential donors of organs as a slippery issue. Ahmad states that use of this source seems to offer benefits to almost everyone involved. While the recipients are rescued from a fatal illness and parents of donors can find some happiness from knowing that their child's short, tragic life had some meaning. Meanwhile the society is spared the cost of caring for a terminally ill child. Finally, instead of watching helplessly as two babies die, health care professionals are able to save one. But the problem he puts forward is that the anencephalic babies do not meet the existing criteria for brain-death and what is the rationale for carrying out non-therapeutic procedure on a non-consenting patient. He states that though the anencephalic patients do not have any functional cerebral cortex, some visual or auditory reflexes can be seen. Definition of brain-death becomes difficult. So should the brain-death be selectively defined separately for the anencephalic babies? Also there is the problem of some of the organs of the babies being small or anomalous and thus unsuitable for transplant purposes. [107]

  The Canadian pediatric society recommended that organ donation from anencephalic babies should not be undertaken because of difficulties in establishment of brain death in these infants. It was stated that there should be no modification of standard of infant brain death criteria for the anencephalic babies. All parents wishing their anencephalic baby to become an organ donor, should be provided with literature and explained why this practice is not supported. The practice of use of ventilator to maintain function till death in anencephalic babies is not supported by the Canadian pediatric society. [108]

  Caplan AL in 1987 discussed whether use of brain dead fetuses or anencephalic infants can be utilized as organ donors. Caplan states that while such a use helps to save existing infants born with fatal conditions while providing solace to grieving parents, the arguments against are that brain death is difficult to diagnose in infants, and that organ procurement from anencephalic baby may be considered as murder. However Caplan concludes that the arguments favoring the use of abortuses, dead fetuses or anencephalic infants for organ or tissue transplants outweigh the arguments against it. [109]
Caplan AL in 2017 states that it is cruel to put an infant in life support solely for purpose of obtaining organs for transplantation. This also means that the healthcare providers would have to withdraw life support causing the infant to die to obtain organs. What healthcare providers are doing is essentially putting the infant on life support and at the same time waiting for him or her to die. There are many healthcare providers who fear that this practice could begin a trend of considering other living beings as organ donors as well, example those in persistent vegetative state or severely disabled.[110]

Cunningham reports that there was a proposal to increase the available organs in the donor pool by harvesting the organs from newborn children who had no chance of survival. Any woman who is carrying such a baby would be supported through the pregnancy, the newborn would be kept on ventilator after birth and then the organs would be obtained.[111]

Cunningham argues the ethics involved here:
She states that the duty of the doctor is to save life of patient. In this case the surgeon who removes the heart of the anencephalic baby causes the death of the child. He states that “No person should be sacrificed for the good of another”.
3.7 Some Legislations pertaining to organ donation

The present section deals with 2 Laws governing organ donation and transplant activity in USA, namely the National organ Transplant Act (NOTA) and the Uniform Anatomical Gift Act (UAGA). It delves into all the aspects that were taken into consideration under the NOTA while creating the organ procurement organizations (OPOs) in USA that procure the organs and the organ procurement and transplant network (OPTN) that maintains the national registry of patients needing organs and matches the available organ to the best recipient following the rules of organ allocation. This is followed by discussion on the UAGA and its revisions over a period of time in relation to organ donation process.

This is followed by a discussion on the Transplant of Human organs Act (THO Act) of India.

Legal aspects of Organ donation in USA [112]

Two main legislations govern organ donation in USA. They are

- National organ Transplant Act (NOTA)
- Uniform Anatomical Gift Act (UAGA)

National organ Transplant Act (NOTA) [112]

Before 1984, there were no specific laws governing all aspects of organ donation. The NOTA was introduced in 1984 by the US Congress. It has the following purposes:

1. Establishment of the Task Force on Organ Procurement and transplantation.
2. Establishment of grants for organ procurement organizations and establishment of the organ Procurement and Transplantation Network (OPTN)
3. Forbids buying or selling of human organs

1. Task Force on Organ Procurement and transplantation.

Within 90 days of the date of enactment of the act the “Secretary of Health and Human Services” established the Task Force on Organ Transplantation. It consisted of
• 9 eminent physicians/ scientists from specialties related to human organ transplantation,
• 3 individuals who would represent the field of organ procurement,
• 4 members who had expertise in law, ethics, health care financing and related sciences,
• 3 members of general public,
• 2 members representing private health insurers.
• The surgeon General of United States, The director of National Institutes of Health, the Commissioner of Food and Drug administration, and Administrator of the Health Care financing Administration

The above 25 members were given the following tasks.

• Examining the medical, legal, ethical, social and economic aspects of Organ procurement and transplantation
• Assess the immunosuppressant medication used to prevent rejection of the transplanted organ, to analyze their safety, effectiveness and cost. They were also to analyze the extent of insurance reimbursement for these long-term drugs by private insurers and the public sector.
• To assess the public and private efforts to procure human organs for transplantation
• To identify factors that diminish organ availability
• Assessing problems in coordinating procurement of viable human organs
• Recommending of education and training of health professionals including physicians, nurses, hospital and emergency care personnel related to organ procurement
• Recommending education of public, the clergy, law enforcement officials, members of fire Department, and members of any other agencies or individuals who may be involved in organ procurement
• Recommending ways of equitable allocations of donated organs.
• Identification of
  ➢ barriers to organ donation
  ➢ organ donors and recipients
  ➢ number of potential donors and their distribution geographically
 Health care provided to patients needing transplants
 Cultural factors affecting the family with respect to donation of organs
 Ethical and economic issues related to organ transplantation

- Recommending research in this field
- Analyzing the factors involved in insurance reimbursement for transplant procedures
- Identification of number and distribution of qualified medical centers for transplantation activity and related procedures from point of view of the project need from the public
- Establishment of a national registry of human organ donors.

Within 12 months of its establishment the task force was to submit its report on all of the above and shall be terminated 3 months thereafter.

2. Establishment of the organ Procurement and Transplantation Network (OPTN) and establishment of grants for organ procurement organizations (OPOs)[112]

The OPTN was established by the NOTA to maintain the national registry of organ matching. This network would be operated by NGOs.

OPTN:

The Secretary of Health and Human Services shall provide $2,000,000 in a fiscal year for establishment of the organ procurement and transplantation network (OPTN).

The OPTN is

- A nonprofit entity
- Is not engaged in any activity besides organ procurement
- It has a board of Directors made of representatives of
   OPOs
   transplant centers
   voluntary health organizations
   general public

The OPTN is a system that matches the available organ with the potential recipients and other donors. For this the OPTN maintains

- A National list of patients needing organs
A national system using computers that matches available organs and individuals included in the list by established medical criteria

It operates a database called “organ center” that has a national computer network that is accessible 24hrs a day 365 days a year. It is run by United network of Organ sharing (UNOS), under contract with the US department of Health and Human services since 1986. It is a non-profit organization. The database is constantly updated by “organ procurement organizations”, transplant centers and histocompatibility labs.

It assists the OPOs in distribution of the organs which is not part of the OPO function

Maintains quality in acquisition and transport of organs

Coordinate transport of organs from OPO to the transplant center

Provide organ donation related information to health professionals

To collect, analyze and publish data related to organ donation

Allocation of organs

Factors taken into account while allocation of organs is the geographic area of both available organs and potential recipient and medical urgency. First the allocation is done regionally and then nationally. Regional distribution is important as the organs must be transported between the donor and recipient in minimum amount of time. More the delay, more the chances of rejection of the transplanted organ. Any available organ will first be made available locally, then regionally and finally if no match is found then to the rest of the country.

USA is divided into 11 regions, each region having its own “Organ procurement Organization(OPO)”

Organ procurement organization:

The Secretary of Health and human Services was to make grants for planning of the OPO

Grants may be allocated for establishment, initial operation and expansion of the OPO

Special consideration was to be given to those OPOs which were in geographical areas not served by OPOs

An OPO which receives such grants as a non-profit organization

It must have its accounting
• It has agreement with the Secretary for reimbursement for procured kidneys, also for non-renal organs provided to transplant centers
• It has defined geographical area which includes at least 50 potential organ donors each year
• It has a director and other staff including organ transplant coordinators and organ procurement specialists necessary to effectively obtain organs from donors
• It has a board of directors comprised of
  ➢ Members representing Hospital administrators.
  ➢ ICU specialists
  ➢ Representatives of tissue banks
  ➢ Voluntary health associations of that area
  ➢ Member representing the public of that area
  ➢ A physician with knowledge of neurology
  ➢ A physician with knowledge of histocompatibility
  ➢ An Organ Transplant Surgeon from each Transplant center in that area
This board of directors has authority to recommend policies for procurement of organs

Functions of the OPO are:

• It should have agreements with majority of Hospitals in its service area (which have facilities of organ donation), to identify organ donors.
• To conduct activities including Professional Education to acquire all useable organs from potential donors
• To arrange for acquiring of donated organs
• To arrange for their tissue typing
• To have a fair system of allocation of organs among the transplant centers of the service area
• To arrange for transport of the of the donated organ to the transplant center coordinating the activity with the transplant center
• To cooperate with tissue banks for similar activities as for organs
• To annually evaluate the effectiveness of the organization in acquiring potentially available organs
To participate in OPTN activities

**Scientific Registry**

Along with establishment of OPTN and OPOs the Secretary of Health and Human Services also shall develop and maintain a **Scientific Registry of the Recipients of organ transplants**. This would help in evaluation of health status of patients of organ transplants.

**Provisions related to Grants and Contracts**

- Grant to be given to only one OPO in one service area.
- Maximum grant for planning in an year was to be $100000 per OPO
- Maximum an OPO can receive for planning or expansion was $800000
- The recipient of the grant was to keep records and face audit

The Secretary of Health and Human Services was to designate and maintain an **Administrative unit in the Public Health service** to coordinate OPO activities, carry out public education regarding organ donation and to provide technical assistance to OPOs who receive funds. This administrative unit must submit an annual report to the Congress on the status of Organ donation and coordination services, also providing a report on analysis of efficiency and effectiveness of the procurement and allocation of organs and a description of problems encountered in organ donation. Finally the Secretary of Health and Human Services shall prepare a Report on the scientific and clinical status of organ transplantation.

3. **Prohibition of Organ Purchases**

   It is unlawful to knowingly acquire or transfer any organ for transplant for money.

**Uniform Anatomical Gift Act (UAGA)**

The UAGA 1968 was the first act dealing with organ donation. It was established to increase the supply of organs, facilitate anatomical gifts and to have uniformity throughout USA. It prevented enactment of “presumed consent”. The law dealt with important topics such as

- Who can be a donor during his lifetime
- Right of next of kin to make anatomical gift from the dead body
- Who can legally become a donor
• How can a gift be made
• How can it be revoked etc

The UAGA 1987 was revised version of UAGA 1968. It made following changes in the earlier law

• Family may not be consulted to give consent, decision of the donor before death is enough. Thus donor decision was strengthened
• If deceased person has not declared decision to be donor, then family can decide
• Prohibition of sale of organs was declared

The UAGA 2006 was the third revision of the Act. The act further strengthened the decision of the donor, barring others from changing his/her decision after death.

• The individual should sign the document of gift (no witnesses necessary)
• If donor physically unable to sign, another person can do so on his behalf (2 witnesses needed)
• The decision given on the driver’s license is legally binding and parents cannot change it.
• The act expanded the list of people who can take decision for the donor in case he/she is incapacitated. This expanded list was made to facilitate organ donation.
• The Hospitals have to donate organs of the deceased despite absence of the donor’s family as long as the deceased had a valid donor card, is in the donor registry or has agreed to be a donor on his driving license. Thus no person can change the individual’s decision regarding organ donation after death.

The NOTA, OPTN, UAGA are the ways in which a country (in this case USA) made laws to govern organ donation, its allocation and pledging for organ donation.

Following are excerpts from THO Act 1994, India followed by excerpts from Transplantation of Human Organs Rules.\textsuperscript{[11]}
The Transplantation of Human organ Act

The transplantation of Human organs act was passed in 1984. It was aimed at regulating retrieval, storage and transplantation of human organs and to prevent commercial dealings in human organs. It has since been amended several times; its rules too have changed.

Aim of the act:

- To provide for the regulation of removal, storage, transplantation of human organs or tissue or both
- To prevent commercial dealings in human organ, tissue or both

New name: The Transplantation of Human organ and tissues (Amendment) Act 2011.

The Act defines:

- **Appropriate authority**: The government can appoint one or more officers as appropriate authority to perform following functions:
  - Grant registration to hospitals
  - Renew registration
  - Cancel registration
  - Enforce standards in Tissue banks and Hospitals sanctioned for transplants
  - To inspect hospitals and tissue banks

- **Authorization committee**
  - Constitutes people prescribed by the central government. The State government can have one or more authorization committees made of members nominated by the state government.
  - This is the committee that analyses each joint application for transplant on its merit and sanctions or does not sanction the transplant surgery

- **Brain stem death**: a stage at which all functions of the brain stem have permanently and irreversibly ceased and it should be so certified.

- **Donor**: A person not less than 18 years of age who voluntarily authorizes removal of his human organ or tissue or both for therapeutic purposes.
• **Human organ retrieval center:** A hospital which has facilities for treating seriously ill patients who can be potential donors in the event of brain death, and which is registered for organ retrieval but not for transplant

• **Near relative:** spouse, son, daughter, brother, sister, mother, father and now recently grandmother and grandfather and granddaughter and grandson have been added to this list of near relatives.

• **Recipient:** A person into whom the human organs or tissues are to be transplanted

• **Transplant coordinator:** a person appointed by the hospital to coordinate all matters removal and transplantation of the organs under provisions of the THO Act.

**Authority to remove human organs of tissues from the body of a person**

The Act describes the situations when someone can have authority to remove human organs of tissues from the body of a person. They are as follows:

- If the person is living and has given authority for such a removal for therapeutic purposes
- If person is brain dead and so certified, then organs can be retrieved from the body if
  - The deceased person had authorized such a removal
  - If no such authorization was done then family can take the decision on behalf of brain dead individual.
  - If the person is below age of 18 years, then the parents can take the decision of authorization for removal of organs.
  - Such a retrieval may not be conducted if an inquest may be required to be held in relation to such a body

Note: It is the duty of the RMP to ensure that the patient is certified as brain dead before above retrieval is conducted.

The Act specifies who can declare brain death:
Brain death is to be declared by a Board of medical experts consisting of:

i. Registered medical practitioner in charge of the hospital in which brain stem death has occurred

ii. An independent RMP, a specialist nominated by above RMP (i) from a panel of names approved by the appropriate authority

iii. Neurologist or neurosurgeon (nominated by above RMP(i) from panel of names approved by appropriate authority)

iv. RMP treating the patient who is brain dead.

*The recent amendment in the THO Act allows for the following: In the event of non availability of the Neurosurgeon or the neurologist, the RMP(i) may nominate another RMP who could be a surgeon or a physician and an anesthetist or an intensivist to carry out the job. (They should not be a part of the transplant team)

Removal of human organs, tissues or both from bodies sent for postmortem examination: The Act allows that the person competent under the Act to give authority for removal of human organs, tissues or both from such a dead body, to authorize removal of the same for therapeutic purposes, if he/she is satisfied that the deceased had so authorized it.

Restrictions on retrieval of organs, tissues or both under the THO Act:

- Organs or tissues or both cannot be retrieved from a living person unless the donor is a near relative of the recipient (in case the donor or the recipient near relative, is a foreign national, prior authorization from the Authorization committee is needed, and the Authorization committee will not approve such a removal if the donor is an Indian national and the recipient is a foreign national unless they are near relatives)
- No organs or tissues or both can be removed from the person below age of 18 years except is some specific circumstances
- No organs or tissues or both can be removed from the person who is not mentally sound
- If the donor is not a near relative of the recipient but by reason of affection or attachment towards the recipient, if the donor authorizes removal of his organs, tissues or both before his death, such a retrieval may not be conducted without
prior approval by the authorization committee. (Such an retrieval is approved in case of swap transplants, for which provision has been made in the THO Act, though it will need prior approval of the authorization committee)

- In each of the above cases the donor and recipient must apply jointly to the Authorization committee which may or may not grant approval after holding in inquiry into the same

The Law clearly states that no removal of organs, tissues or both can be conducted in any Hospital unless it is registered under the ACT. (In case of retrieval of the eye, the said eye bank must be registered) The certificate of registration shall be given for a specified period of time by the Appropriate authority and can be suspended or cancelled, in case of a complaint.

The Act allows for creation of an “Advisory committee” for a period of 2 years, that may advise the appropriate authority to discharge its functions.

The Act specifies that the central government may establish a National Human Organs and Tissues removal and storage network at one or more places and a regional network

The central government will maintain a national registry of donors and recipients.

**Punishments under the THO Act:**

- If a person conducts or associates with, removal of human organs without authority, they shall be punishable with imprisonment for a period of maximum 10 years and a fine extending to 20 lakh rupees.
- If the said person is an RMP, his name shall be reported by the appropriate authority to the Medical council for taking action such as removal of name from the register for 3 years in case of first offence and permanently in subsequent offence.
- If a person makes or receives payment for human organs, sees a person willing to supply payment, offers to supply human organ for such payment, initiates an agreement to supply human organ, publishes any advertisement inviting for persons to supply human organs for payment, or offer payment for human organs, abets preparation of false documents to establish false credentials of donor, then
he or she shall be liable for imprisonment not less than five years and a fine not less than 20 lakh rupees extending upto one crore rupees.

- In case all of the above offences are carried out for human tissues then they are punishable with imprisonment from 1 year to 3 years and a fine extending from five lakh rupees to 25 lakh rupees.

No action can be taken against a person who in good faith conducts an act in pursuance of the provisions of the Act.

The Central Government may make rules, by notification to carry out purposes of this Act.

Rules define the guidelines that must be followed for successful implementation of the Act. Hence the THO Act has rules, Transplantation of Human organs Rules. March 2014[114]

These rules specify hospital level details such as registration of a hospital for transplant, the forms to be filled by the living near relative, spouse or living non near relative, qualification of person carrying out each of the different types of transplants etc. Forms to be filled to certify brain death are also part of the rules. The application of the THO Act at the public level is guided by these rules.

Points to be noted in this study of Acts from two different countries:

- The UAGA Act protects the decision of the donor which cannot be vetoed by the family members.
- UAGA Act gives power to the declaration for organ donation on the driver’s license which also the family cannot override.
- Under the UAGA Act, organ retrieval will take place even if family members are not present if the driving license shows the state of donor
- Categories of persons who can give permission for organ donation of an incapacitated person have been expanded in the UAGA Act.
- The THO Act allows the family member of the donor to make the final decision thus reducing the importance of signing the donor card.
- Follow up of cases of both recipients and donors have been incorporated within the NOTA Act itself. This results in effective simultaneous data collection.