Transplant surgery

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What it means?

• Organ transplantation is the moving of an organ from one body to another, or from a donor site on the patient's own body, for the purpose of replacing the recipient's damaged or absent organ.

• The emerging field of Regenerative medicine is allowing scientists and engineers to create organs to be re-grown from the patient's own cells (stem cells, or cells extracted from the failing organs).
Types of transplant

- **Autograft** - Transplant of tissue to the same person.
- **Allograft** - is a transplant of an organ or tissue between two genetically non-identical members of the same species.
- **Isograft** - A subset of allografts in which organs or tissues are transplanted from a donor to a genetically identical recipient (such as an identical twin).
- **Xenograft and xenotransplantation** - A transplant of organs or tissue from one species to another. An example are porcine heart valve transplants, which are quite common and successful.
- **Orthotopic graft**: a graft placed in its normal anatomical site.
- **Heterotopic graft**: a graft placed in a site different from that where the organ is normally located.
Transplantable organs and tissues
Transplantable organs and tissues

• Thoracic organs
  • Heart (Deceased-donor only)
  • Lung (Deceased-donor and Living-Donor)
  • Heart/Lung (Deceased-donor)

• Abdominal organs
  • Kidney (Deceased-donor and Living-Donor)
  • Liver (Deceased-donor and Living-Donor)
  • Pancreas (Deceased-donor only)
  • Intestine (Deceased-donor and Living-Donor)
  • Stomach (Deceased-donor only)
  • Testis
**Tissues, cells, fluids**

- **Hand** (Deceased-donor only)
- **Cornea** (Deceased-donor only)
- **Skin** including **Face transplant**
- **Islets of Langerhans** (Deceased-donor and Living-Donor)
- **Bone marrow/Adult stem cell** (Living-Donor and Autograft)
- **Blood transfusion/Blood Parts Transfusion** (Living-Donor and Autograft)
- **Blood vessels** (Autograft and Deceased-Donor)
- **Heart valve** (Deceased-Donor, Living-Donor and Xenograft)
- **Bone**
Types of donor

- Organ donors may be *living, or brain dead.*
- Brain dead means the donor must have received an injury (either traumatic or pathological) to the part of the brain that controls heartbeat and breathing. Breathing is maintained via artificial sources, which, in turn, maintains heartbeat. Once brain death has been declared the person can be considered for organ donation.
- Tissue may be recovered from donors who are cardiac dead. That is, their breathing and heartbeat has ceased. They are referred to as *cadaveric donors.*
Living:

- In "living donors", the donor remains alive and donates a renewable tissue, cell, or fluid (e.g. blood, skin), or donates an organ or part of an organ in which the remaining organ can regenerate or take on the workload of the rest of the organ (primarily single kidney donation, partial donation of liver, small bowel).
Deceased

- Deceased (formerly cadaveric) are donors who have been declared **brain-dead** and whose organs are kept viable by ventilators or other mechanical mechanisms until they can be excised for transplantation.

- Apart from brain-stem dead donors, who have formed the majority of deceased donors for the last twenty years, there is increasing use of Donation after **Cardiac Death Donors** (formerly non-heart beating donors) to increase the potential pool of donors.
Heart – can only be retrieved from a HBD.

Liver – can be retrieved from a HBD & NHBD. A liver lobe can be taken from an LD.

Small intestine & bowel – can only be retrieved from a HBD.

Kidney – can be retrieved from a HBD, NHBD & LD.

Pancreas – can only be retrieved from a HBD.

Single or double lung – usually retrieved from a HBD, but can be a NHBD. A lung lobe can be taken from an LD.

Outside the UK tracheas, ovaries, male reproductive organs, faces, arms & hands have been transplanted.

HBD = heart beating donor (ventilated - BSD)
NHBD = non heart beating donor
LD = living donor – usually a blood relative
Evaluation of donor:

- Contra indication of organ donation are
  - Presence of HIV infection
  - Hepatitis B infection
  - Active systemic sepsis – e.g. Major abdominal infection
  - Presence of malignancy within last 5 yr, except
    - Low grade primary tumor of CNS
    - Non –melanotic tumor of skin
    - Ca. in situ of uterine cervix
Age of the donor:

Chonological age of donor is less important than the physical function of the organ under consideration for transplantation. Acceptable donor age ranges are –

- Kidney – 2yrs to no upper age limit
- Liver – no age limit
- Heart – 0 - 65 yrs
- Pancreas – 10 – 50 yrs
Organs to be donated: should be free from primary disease.

- Kidney – no evidence of primary renal disease with good urine output and normal serum urea and creatinine level
- Liver – no hepatic disease
- Heart – no H/O heart disease with normal ECG
- Pancreas – no H/O DM
Organ Sharing System

Donors

Organ Procurement Agency

UNOS Organ Center

Transplant Center

Recipients
Organ procurement:

  - After dissection of the organs to be procured, they are perfused in situ.
    - Heart is perfused with cold cardioplegia solution
    - Abdominal organs are perfused with chilled organ preservation solution via an aortic and portal canula.
  - This procedure causes rapid cooling of the organs → decrease metabolic activity → preserves their viability.
– Additional surface cooling of abdominal organs are achieved by application of saline ice slush.

– Kept in chilled preservation solution – University of Wisconsin (UW) solution. Composition is like that of intra cellular fluid. Times for preserving the organ by transplant are –
<table>
<thead>
<tr>
<th>Organ</th>
<th>Optimum (hr)</th>
<th>Safe maximum (hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kidney</td>
<td>&lt;24</td>
<td>48</td>
</tr>
<tr>
<td>Liver</td>
<td>&lt;12</td>
<td>24</td>
</tr>
<tr>
<td>Pancreas</td>
<td>&lt;10</td>
<td>24</td>
</tr>
<tr>
<td>Small intestine</td>
<td>&lt;4</td>
<td>8</td>
</tr>
<tr>
<td>Heart</td>
<td>&lt;3</td>
<td>6</td>
</tr>
</tbody>
</table>
– Then place in 2 sterile plastic bags and store at 0 – 4°C by immersion in ice then transport to the recipient centre.

**Resumption of function following organ transplantation:**

• Heart, lung and liver resume satisfactory function immediately after transplantation. If not, rapid retransplantation is to be done.

• After kidney, pancreas or small bowel transplantation, immediate graft function is desirable but not vital.
GRAFT REJECTION

- **Transplant rejection** occurs when a *transplanted* organ or tissue is not accepted by the body of the transplant recipient. This is explained by the concept that the *immune system* of the recipient attacks the transplanted organ or tissue. This is expected to happen, because the immune system's purpose is to distinguish foreign material within the body and attempt to destroy it, just as it attempts to destroy infecting organisms such as *bacteria* and *viruses*. When possible, transplant rejection can be reduced through *serotyping* to determine the most appropriate donor-recipient match and through the use of *immunosuppressant drugs*. 
Details of HLA

- HLA=Human Leukocyte Antigens which are found on the surface of WBC
- Function of HLA is to help identify and in turn, fight “foreign stuff”
- 2 types of HLA: some for MHC I and MHC II (MHC genes are on chromosome 6)
- Most important HLA are types A, B (MHC I) and DR (MHC II)
- Remember MHC I present antigens to cytotoxic T cells and MHC II use antigen-presenting cells for helper T cells
- For this reason, it is important to have closely matched HLA between donor and recipient to avoid rejection—ie. To avoid donor cells being presented to recipient immune system by MHC for destruction
Types of graft rejection

• **Hyperacute**
  - Immediate graft destruction due to ABO or pre-formed anti-HLA antibodies.
  - Characterised by intravascular thrombosis

• **Acute**
  - Occurs during the first 6 months
  - T-cell dependent, characterised by mononuclear cell infiltration
  - Usually reversible
Chronic

- Occurs after the first 6 months
- Most common cause of graft failure
- Non-immune factors may contribute to pathogenesis
- Characterised by myo-intimal proliferation in graft arteries leading to ischaemia and fibrosis
tHanK yOu!

SUPPORT ORGAN & TISSUE DONATION TO SAVE FUTURE GENERATIONS!