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Biomaterials



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BIOMATERIALS

المحاضرة العاشرة

SOFT TISSUE REPLACEMENT — II: BLOOD INTERFACING IMPLANTS

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An overview of organ transplantation

organ transplantation is the process of removing cells, tissues, or living organs from the body, and then transferring them back to the same body or to another body.

the most common type of organ transplant is [blood transfusion](#). blood transfusions are used to treat millions of patients each year.

the transplant process consists of:

- the patient's own tissues.
- tissues from real twins, urges that his genes match exactly the patient's.
- tissues from a person whose genes don't exactly match the patient's.
- in rare cases, tissues from non-human beings (e.g. pig)

cultivated tissue can be

- cells, as in [stem cell transplantation](#)
- part of an organ, as in some types of [liver transplantation](#) or [lung transplantation](#).
- an entire organ, as in [a heart transplant](#). or [kidney transplantation](#).
- [more than one fabric](#). (called multiple or composite organ transplants)

unlike blood transfusions, transplantation involves major surgical procedures, the use of medications to inhibit the immune system, and the process has the potential to reject the transplanted organ, as well as many serious complications that can lead to death.

some transplants, such as hand or facial transplants, can greatly improve a patient's quality of life, but are not performed to save him from death.

donors

a donor can have tissues or organs

- a living person.
- deceased person (deceased donor)

tissues and organs are often preferred from living donors, because they are usually in better health. stem cells (whether from bone marrow or blood) and kidneys are often taken from living donors. in order to donate a organ, financial compensation is permitted in return for cell and tissue donation.

it is clear that some organs, such as the heart, cannot be taken from living donors.

in many u.s. states, people can indicate their willingness to donate organs to their driver's license, although family members are often consulted before taking organs from a deceased, even with indications that they are willing to donate their organs after death. the donor may be in good health before his death, then he has suffered a serious accident leading to his death, and the donor may have a medical condition that does not affect the donor organ and led to his death.

for example, one donor can provide two corneas, a pancreas, two kidneys, two liver lobes, two lungs, a small intestine and a heart.

you know what...

the deceased donor can provide two corneas, one pancreas, two kidneys, two liver lobes, a fine intestine, two lungs and a heart.

complications after transplantation

complications that can occur after organ transplantation include:

- rejection of the transplanted organ
- infection
- cancer
- arteriosclerosis
- kidney problems
- osteoporosis

in addition to suppressing the immune system's reaction to the transplanted organ, these medications also reduce the immune system's ability to fight infection and sabotage cancer cells.

Rejection of the transplanted organ

if the body rejects the new organ, rejection often occurs after transplantation, but may also occur after weeks, months or even years.

symptoms of rejection vary depending on the organ transplanted and the timing of rejection.

Infection

there are several factors that increase the risk of infection in the recipient of the transplanted organ:

- surgery
- use of immunosuppressive inhibitors
- immune system problems caused by organ failure that necessitated the transplant

infections that may develop in the recipient of the transplanted organ, and include the same conditions as those of any patient recovering from surgery. these infections include infections at the surgical site, infection within the transplanted organ, pneumonia, and urinary tract infections.

transplant patients also face the risk of an unconventional infection (opportunistic infection) that mainly affects patients with weakened immune systems.

- Bacteria (such as *Listeria* or *Nocardia*)
- viruses (e.g. cytomegalovirus, bk virus, or epstein-barr virus)
- Fungi (e.g. *Pneumocystis jirovecii* or *Aspergillus*)
- Parasites (such as *Toxoplasma*)

after the transplant, most patients are given antimicrobial drugs to help prevent infection. after 6 months, the risk of infection is reduced to what it was before the new organ was transplanted in about 80% of patients.

Cancer

the risk of certain cancers increases when using immunosuppressive inhibitors for a long time, and their risk increases after transplantation.

treatment for these cancers is similar to treating patients who have not had a transplant.

Arteriosclerosis

Arteriosclerosis may occur (fatty substances are deposited in the arteries) because some immunosuppressants cause increased cholesterol and other fat levels.

atherosclerosis usually occurs about 15 years after kidney transplantation.

Renal problems

kidney problems develop in about 15-20% of transplant patients, especially small intestine transplants.

factors that may contribute to kidney problems include:

- high doses of immunosuppressants (especially cyclosporine and tacrolimus)
- physical stress associated with transplant surgery

Osteoporosis

the use of immunosuppressive inhibitors (especially corticosteroids) leads to **osteoporosis** these patients include people living still, smokers, alcoholics or kidney patients.

the use of immune suppressors in children can lead to stunted growth.

Doctors investigate osteoporosis in most patients before the transplant. bisphosphonates) to help prevent bone density deficiency.

Complications in the donor

some of these complications include those that may occur after any surgery, such as infection and bleeding.

stem cell transplantation

stem cell transplantation is the removal of stem cells (non-differentiated cells) from a healthy person and injected into a person with a serious blood disorder.

stem cells are non-specialized cells through which other more specialized cells can be produced.

- the blood of the baby's umbilical cord after birth (donated by his mother).
- bone marrow transplant.
- Blood.

blood is preferred over bone marrow as a source of stem cells, because the procedure is a few, and blood cell counts return to normal more quickly.

what are stem cells?

stem cells are non-differentiated cells that have the potential to become one of the more than 200 distinct cell types in the body, including blood cells, neurons, muscle cells, heart cells, glandular cells, and skin cells.

some stem cells can be stimulated to convert to any type of cell in the body.

stem cells multiply by division, producing more stem cells, until they are stimulated to begin the process of differentiation.

researchers hope to use stem cells to repair or replace cells or tissues that have been damaged or destroyed by disorders such as parkinson's disease, diabetes, and spinal injuries.

researchers have been able to obtain stem cells from the following sources:

- embryos before completing the age of 8 weeks in the uterus (embryo chew).
- embryos after completing the age of 8 weeks in the uterus (fetus).
- umbilical cord blood.
- bone marrow in children or adults.
- stimulating poly-potency stem cells (cells taken from adults can be changed to act like stem cells).

chewing: during in vitro fertilization, male sperm is placed with several female eggs in the implant dish.

since the chews from which stem cells are taken lose the ability to grow to a whole human being, the use of stem cells from embryos remains controversial among researchers. but researchers believe these stem cells have the greatest ability to produce different types of cells and survive transplantation.

embryos: after the chewing is 8 weeks old, it is called the fetus.

umbilical cord: stem cells can be obtained from the blood in the umbilical cord or placenta after the birth of the child.

children and adults: bone marrow and the blood of children and adults contain stem cells.

stimulating poly-potency stem cells: researchers are developing ways to stimulate other cells (such as blood cells or skin cells) to act as stem cells.

stem cell transplantation can be used as part of the treatment of blood disorders, such as [leukemia](#) leukemia and specific types of lymphoma (including [hodgkin's lymphoma](#)) and [artificial anemia](#). And [thalassemia](#). and [sickle cell disease](#), and some congenital metabolic disorders or immunodeficiency disorders (e.g. [chronic granular tumor disease](#)).

stem cell transplants may also be performed in patients treated for certain cancers using high chemical or radiological doses. some of these treatments can destroy bone marrow, which produces stem cells. stem cell transplants can sometimes be used to replace bone marrow cells that have been destroyed by organ cancers, such as breast cancer or neuroblastoma (a common cancer in children developing from nervous tissue). stem cells

about 30-40% of patients with lymphoma and 20-50% of patients with leukemia fully recover after treatments, including stem cell transplantation.

surgical procedure

stem cells can be

- taken from the patient himself (autologous transplantation self-transplantation)
- taken from a donor (allogeneic transplantation)

if cells are used by the same patient to treat cancer, stem cells should be collected before chemotherapy or radiotherapy, because these treatments may damage stem cells.

if stem cells are taken from a donor, the patient should be given medications to inhibit the immune system ([immunosuppressants](#)) before stem cell transplantation.

from the blood.

initially, a few days before the stem cells are obtained, the donor is given a drug that stimulates bone marrow to release more stem cells into the bloodstream. stem cells can be preserved for later use by freezing them.

from bone marrow.

to grow bone marrow, the donor should initially be sedated generally or locally.

to the recipient.

stem cells are injected into the recipient's vein over an hour to two hours.

after stem cell transplantation

medications are given to the patient after stem cell transplantation, in order to prevent complications (see below).

you usually stay in the hospital for one to two months.

after discharge, you should make follow-up visits to your doctor on regular schedule.

complications

infection

stem cell transplantation is a risky process, because the recipient's leukocytes have been destroyed or reduced by chemotherapy or radiotherapy.

the risk of infection can be reduced by keeping the recipient in isolation for a period of time (until transplanted cells begin to produce white blood cells).

the recipient is being given

- growth factors, which stimulate blood cell production
- antimicrobial drugs to reduce the risk of infection

fundamental disorder setbacks

the underlying disorder setbacks or not depend on:

- what is the underlying disorder.
- how dangerous it is.
- stream implant type.

the original disorder is inxed by

- 40 to 75% of patients treated with their stem cells
- 10 to 40% of patients treated with stem cells taken from donors