



Kidney Transplant Rejection

Teacher information

Summary:

Students read and answer questions about an article on kidney transplant rejection.

Core concepts:

- The immune system protects against antigens associated with foreign substances.
- Some white blood cells produce antibodies that attack invaders or mark them for killing.
- Sometimes the immune system may attack transplanted organs

Class time required:

Homework or 20 minutes of class time

Teacher preparation:

Each student will need

- 1 copy of "*Kidney Rejection*"

This project was generously funded by Science Education Partnership Award R25RR023285 from the National Center for Research Resources. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Center for Research Resources or the National Institutes of Health.

Kidney Transplant Rejection: **Teacher Answer Key**

Use the information in the reading passages to answer the questions.

Living with a New Organ

As with most other surgeries, recovery from an organ transplant operation involves additional medication and hospital visits to make sure the incisions heal correctly. But while other surgery patients typically can move on from the experience, most transplant recipients must continue medical treatment for the rest of their lives. This is because of the immune system's reaction to the new organ.

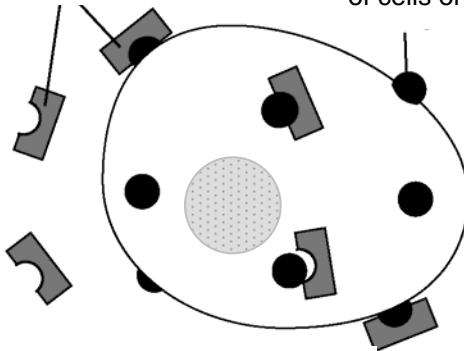
The immune system includes all the parts of the body that keep foreign cells like bacteria, viruses, and parasites from destroying organs and tissues. The immune system attacks foreign cells and destroys them. Anything that can trigger an immune system attack is called an *antigen*.

A healthy immune system has the remarkable ability to distinguish between the body's own antigens (called "self" antigens) and foreign antigens (called "nonself" antigens). The body's immune defenses normally coexist peacefully with cells that carry distinctive "self" antigens. But when the immune system encounters cells or organisms carrying "nonself" antigens it quickly launches an attack. The immune system's white blood cells make specific proteins called *antibodies* and special cells called *T cells* that destroy the foreign cells.

A transplanted organ is made entirely of cells with foreign ("nonself") antigens which means the body will attack the transplanted organ. To minimize the immune response, donors and recipients should have matching antigens on their blood and tissues. But even with a good antigen match, the recipient's body may see the cells of the new organ as foreign and may reject the organ (by destroying it cell by cell). Only donated tissue from an identical twin will be fully accepted by a recipient's body.

An **antibody** is a protein produced by white blood cells in response to an antigen.

An **antigen** is a large molecule (usually a protein) on the surface of cells or viruses.



Foreign cell bearing surface antigens

The **immune system** recognizes antigens and produces antibodies that destroy substances containing antigens.

1. What is the difference between an antibody and an antigen?

An antigen is a substance that triggers an immune response. An antibody is a substance produced by an immune response.

2. How does the transplant patient's body recognize that the transplanted organ is made of foreign cells?

It recognizes antigens on the organ that are different (foreign or not present) in the patient.

3. What changes occur in the patient's body during the organ rejection process?

In response to these foreign antigens, the immune system makes specific antibodies and T cells that destroy the foreign cells.

Preventing Kidney Transplant Rejection

The most critical part of kidney transplantation is preventing rejection of the transplanted kidney. There are three types of rejection that might occur following a transplant.

1. Hyperacute rejection occurs as soon as the donated organ is in the body. This only happens if there are already antibodies in the recipient's bloodstream that react to the new organ, which would occur if the blood types of the donor and recipient were incompatible for some reason. This almost never happens, since transplant teams always test the donor and the recipient before the transplant surgery for any antibodies that might be incompatible. If a hyperacute rejection were to happen, the recipient would most likely die during or immediately after the surgery.

2. Acute rejection occurs at least a few days after the transplant, after the body has had time to recognize the foreign antigens and make an immune response to them. To prevent acute rejection, transplant patients are treated with immunosuppressive drugs. Immunosuppressive drugs block the immune system action by reducing the production of antibodies or T cells by white blood cells.

The problem with immunosuppressive drugs is that they also suppress some of the beneficial things the immune system does. A person taking immunosuppressive drugs is much more susceptible to infection (since their body is less able to fight off germs) and they are also more susceptible to other diseases, including cancer. A transplant patient will need to take a specific combination of immunosuppressive drugs to achieve the right balance of suppression. The goal is to suppress the immune system just enough to prevent rejection, while minimizing side effects and the risk of infection.

3. Chronic rejection is a very gradual rejection, lasting months or years. It can be so subtle that the patient doesn't notice any ill effects for some time. Chronic rejection is more likely if patients are not careful about follow-up tests, following the treatment plan recommended by their doctor and maintaining a healthy lifestyle.

4. What could be done to prevent hyperacute rejection?

Make certain that the kidney is compatible with the patient's body OR Make certain that the patient is not already producing antibodies against the kidney.

5. What could be done to prevent acute rejection?

Treat the patient with immunosuppressive (anti-rejection) drugs to reduce the production of antibodies and T cells.

6. What could be done to prevent chronic rejection?

Have follow-up tests, follow the treatment plan recommended by their doctor and maintain a healthy lifestyle.

7. Describe 2 long term risks may be associated with the use of anti-rejection drugs?

These drugs might lead to increased disease due to a decreased ability to fight germs and cancer cells.

8. If there are long term risks associated with the use of anti-rejection drugs, why would doctors and patients consider using them?

The risk of kidney rejection is far greater than the long term effects of anti-rejection drugs.