

Genetics of Transplantations

Transplantation means transfer body part or tissue from one organism to another or to other locations within the same organism. The main problems which occur in transplantations are mainly genetic differences of organs and tissues between individuals. The important role played by the **major histocompatibility complex (MHC)**, which recognize foreign antigens and neutralize them.

Types of Transplants

▪ Auto-transplant

Transferring tissue from one place to another *on the same body*. Does not induce any immunological reaction - graft MHC perceive themselves as their own.

▪ Iso-transplant

Transfer *between two organisms with the same genetic basis*. Examples are transplantation in identical twins.

▪ Allo-transplant

Transfer *between two organisms of the same species*. The most frequently occurring type. The problem is the varying genetic background. There is risk of immune reaction and rejection of the graft.

▪ Xeno-transplant

Transmission *from one species to another*. A very rapid rejection response happens due to differences in the genome. Most often the response is IgM or cell-mediated.

Rejection of the Graft

Although *B-cells* and *antibodies* contribute to the rejection reaction, **T-cells** have the major role. Their reaction is dependent on antigen presentation via MHC through T-helper cells (T_H) and lymphokines. This results in production of **interleukin 2** (IL-2), which activate the T_C -cells.

The rejection of the graft is not a steady process. Response is mostly directed against *vascular endothelial cells* or *parenchymal cells* of the organ.

Role of T-cells in rejection was confirmed by tests on mice. In mice with congenital aplasia of the thymus was observed the inability to reject of transplants. The same effect was also shown by surgical removal of the thymus together with radiotherapy removing the rest of immunocompetent T-cells in the body. On the contrary, injection of T-cells of these mice leads to rapid and aggressive response.

Types of Rejection

▪ Hyperacute Rejection

It occurs rarely, particularly in patients who *already have antibodies in their blood graft* (blood transfusions, pregnancy or a previous graft rejection). There is a vascular endothelial cell destruction, leading to clot formation and blockage of blood supply to the graft.

▪ Acute Rejection

It takes days to weeks before rejection occurs. The main role of the T-cells, often in *previously sensitized patients*.

▪ Chronic Rejection

Dependent on *genetic differences between donor and recipient*. It is a slow process that can take months to years. For this type of rejection is characterized by luminal obliteration of blood vessels and intestinal fibrosis. It often occurs in the transplanted kidney and ten years after surgery.

Laws of Transplantation

Host reaction against graft - HvGR

It occurs in transplantation, *antigens that are present* in the recipient. Especially in allotransplants. Body graft reject it. Examples:

- donor type A + recipient type A = acceptance
- donor type B + recipient type A = rejection
- donor type B + recipient type A / B = acceptance

- donor type A/B + recipient type B = rejection

Graft reaction against host - GvHR

If the graft contains *competent T-cells*. All cells of the transplant are recognized by T cells as foreign. Graft begins to reject the recipient, especially since they are often immunosuppressed and are unable to attack these aggressive foreign T-cell response. Graft is highly dangerous for the recipient. The emergence of a strong inflammatory response leads to serious disability and the patient very often die.

The host tolerates graft at:

1. *newborn* - is not fully developed immune system
2. *adult with discarded immune system* (radiation, immunodeficiency pathology, etc.)

Links

Related articles

Lymphokines

T-cells

The Major Histocompatibility System of Man

Sources

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