

Transplant Immunology

Transplantation is the process of moving cells, tissues, or organs from one site to another for the purpose of replacing or repairing damaged or diseased organs and tissues. However, the immune system poses a significant barrier to successful organ transplantation when tissues/organs are transferred from one individual to another.

Rejection is caused by the immune system identifying the transplant as foreign, triggering a response that will ultimately destroy the transplanted organ or tissue. Long-term survival of the transplant can be maintained by manipulating the immune system to reduce the risk of rejection.

Donor and recipient are carefully matched prior to transplantation to minimize the risk of rejection. They are matched based on their blood group, tissue typing, and how the recipient's blood serum reacts to donor cells.

When as a result of disease or injury, an organ or tissue becomes irreparably damaged, or when an organ is congenitally defective or absent, transplantation or grafting becomes a must. The tissue or organ transplanted is known as the transplant or graft. The individual from whom the transplant is obtained is known as the donor and the individual on whom it is applied is the recipient.

Transplant immunity is predominantly **cell-mediated**.

Classification of transplants:

1. Based on the organ or tissue transplanted, they are classified as kidney, heart, skin transplant, etc.
2. Based on the anatomical site of origin of the transplant and the site of its placement, grafts are classified as orthotopic (anatomically normal sites) and heterotopic (anatomically abnormal sites).
3. Transplant may be of fresh tissue or organs or of stored ones.
4. Transplants may be of living or dead materials. Live grafts are expected to survive and function physiologically and are called vital grafts. Non-living transplants like bone or artery merely provide scaffolding on which the new tissue is laid by the recipient.
5. Transplants may be classified based on the genetic (and antigenic) relationship between the donor and the recipient.

Autograft: An organ or tissue taken from an individual and grafted on himself is an autograft.

Isograft: A graft taken from an individual and placed on another individual of the same genetic constitution is called an isograft.

Allografts: Grafts between two genetically nonidentical members of the same species are called allografts. (Previously called homo-grafts).

Xenografts: Grafts between members of different species are called Xenografts. (Previously called heterografts).

Graft Rejection

In the case of skin grafts in genetically unrelated animals, the graft appears to be accepted initially (first 2-3 days, the graft is vascularized and seems morphologically healthy).

About 4th day inflammation sets up and the graft is invaded by lymphocytes and macrophages. Vascularity diminishes, blood vessels are occluded by thrombi and the graft undergoes ischemic necrosis. When extending the necrosis, the graft assumes a scab-like appearance and sloughs off by the 10th day. This sequence of events resulting in the rejection of the allograft is known as the ***first set response / first set reaction / rejection***.

In an animal that has already rejected a graft by the *first set response*, another graft from the same donor will be rejected in an accelerated manner. Vascularization commences but is soon interrupted by an inflammatory response. Necrosis sets in early and the graft sloughs off by the sixth day. The accelerated allograft rejection is known as the ***second set response***.

Histocompatibility Antigen:

Antigens participating in graft rejection are called 'transplantation or histocompatibility antigens. The term 'Major histocompatibility systems' is applied to a system of cell antigens that exert a decisive influence on the fate of allograft.

The major histocompatibility systems in humans is HLA, whereas in bovines BoLA. Major histocompatibility systems have been identified in different species.

Graft Vs Host Reaction:

Graft reaction is due to the reaction of the host to the grafted tissue (host-verses-graft response).

Graft vs. host reaction occurs in one of the following conditions:

1. The graft contains immunocompetent cells.
2. The recipient possesses transplantation antigens that are absent in the graft.

Examples of situation leading to the Graft Vs Host reaction are:

1. Allograft in a recipient in whom specific immunotolerance has been induced.
2. Adult lymphocytes injected into an immunologically deficient recipient.
(Immaturity/immunosuppression)

Major clinical features of Graft Vs Host reaction in animals are retardation of growth, emaciation, diarrhea, anaemia, hepatic and spleno-megally terminating fatally (Runting syndrome).

Reference

Veterinary Immunology, Tenth Edition, 2018. Ian R. Tizard. Organs of the immune system.

<https://www.immunology.org/policy-and-public-affairs/briefings-and-position-statements/transplant-immunology>
