EDITORIAL

THERAPEUTIC USES OF IMMUNE SYSTEM: NEW POSSIBILITIES, NEW HOPES

Tehseen Iqbal
Ghazi Khan Medical College, DG Khan, Pakistan

Our immune system is an amazingly complex system that is ill-defined anatomically but relatively well-defined physiologically. The fact is that we still don't have a thorough knowledge of this important body system. Our Immune system is capable of defending ourselves against invading pathogens; removing old, worn out or damaged body cells; identifying and destroying the foreign cells; identifying and destroying the abnormal, infected, mutant and cancer cells. The immune system, anatomically, consists of white blood cells (WBCs), tissue cells derived from WBCs, the thymus, the bone marrow, the lymph nodes and the lymph vessels. Antibodies, interferon, and complement system are the chemical weapons and the cytokines are the major communicating chemicals of the immune system. Cytotoxic T Lymphocytes (CTL) in our immune system are the most potent killers of foreign cells. Cytotoxic T lymphocytes (also called T-effecter cells, T_{eff} or T_C) and the Natural Killer (NK) Lymphocytes can recognize and destroy the cancer cells.[1,2]

Different cells in the immune system convey messages through exchanging cytokines. Cytokines are chemicals secreted by some immune cells and affect the other immune cells to mount an appropriate immune response. Cytokines include chemicals like interleukins, interferons, and growth factors.[3] Latest advances in the fields of neuroscience and immunology have revealed that neural reflexes also modulate the immune system. Activating the Vagus nerve affects the cytokine production by leukocytes.[4]

All cells of the immune system are generated as immature stem cells in the bone marrow. These stem cells respond to different types of cytokines and other signals and they grow into specialized immune cells like T cells, B cells, or phagocytes. Because stem cells are non-committed cells, they can be considered a promising possibility for treatment of some immune system disorders. Researchers are investigating if a person's autologous stem cells can be used to regenerate damaged immune responses in autoimmune disorders and immune deficiency disorders.[5] Haynesworth *et al* (1992a & 1992b) were able to isolate and culture human mesenchymal stem cells (MSCs) in therapeutic quantities. Studies have also indicated the capability of MSCs to differentiate into neural precursors, cardiomyocytes and possibly other cell types which can be useful in treating difficult conditions like stroke and myocardial infarction.[6]

The study of the immune system as a distinct body system is relatively recent. Although its origins can be traced to Edward Jenner in the late 18th century who first discovered that humans could be protected against smallpox by inoculation with cowpox virus, which is a relative of the smallpox virus.[7] Cowpox virus was also known as vaccinia, so the process was named as vaccination. In medicine, vaccination, or immunization, is considered as the greatest triumph of the field of immunology. This is a procedure in which severe disease can be prevented by prior exposure to the infectious agent in a form that cannot cause a full-blown disease. Actually, vaccination prepares the immune system before hand to recognise the infective agent and to get ready to make a protective response in case of attack by the microorganisms. This protection is provided with little risk to health or life of the individual.[8]

Scientists are now able to produce immune system chemicals like antibodies and cytokines, as well as specialized immune cells on large scale. The large scale supply of these materials has revolutionized the study of the immune system and its components. It also has had a great impact on medicine, agriculture, and industry.[5] BCG Vaccine is an attenuated, live culture preparation of the Bacillus of Calmette and Guerin (BCG) strain of Mycobacterium bovis. BCG vaccine provides protection against tuberculosis (TB). It is also being used to treat bladder tumours or bladder cancer.[9]

Immune system function can now be enhanced, suppressed or successfully modified to the benefits of the host. Its activity is enhanced through immunization. Its activity is therapeutically suppressed in patients of organ transplantation. Immune system suppression is a common side effect of chemotherapy for cancer and patients undergoing such treatment become more susceptible to opportunistic and other infections. A class of herbal medicines, known as immunomodulators, alters the activity of immune system function through the dynamic regulation of messenger molecules such as cytokines.[10]

In the early twentieth century, Paul Ehrlich first proposed that the immune response of the patient can be developed against tumours. It is now proved through research that many cancer patients can bring

about serological as well as cellular immune responses against their own cancer cells. We are hopeful that these serological products can be used as vaccines. We also hope that these therapeutic cancer vaccines will successfully recruit the Cytotoxic T-Lymphocyte attack on cancer cells, with the minimal adverse effects on the patients.[11] As our knowledge for CTL cell activation grows, it has unveiled new opportunities to directly modulate CTL cells to launch optimal anti-tumour responses.[12] Observation supports that therapeutic activation of Cytotoxic T-lymphocyte may also cause durable cancer regression.[13] A short course of daily Tadalafil treatment is sufficient to increase the percentage of tumour-specific CTL cells in circulation and promote the activation of these cells at the tumour site. This observation provides the rationale for new therapeutic strategies in human malignancies.[14]

Dendritic cells (DCs) are bone marrow-derived antigen-presenting cells (APCs). They play an essential role in the production and regulation of immune responses. It has been proposed that the DCs can be used as a 'natural' vaccine adjuvant and that may prove to be a very effective way to stimulate anti-tumour immunity.[14]

The future of cancer immunotherapy seems to be a promising one because of a number of latest discoveries and new techniques. The reason why cancer immunotherapy is not yet in widespread use is that we still have gaps in our knowledge about the human immune system. Latest studies are examining the possibility to use immunotherapy in conjunction with radiation and chemotherapy to increase the effectiveness of patient responses. Researchers can now reproduce natural body products that can be used as drugs in the treatment of many diseases, including cancer. Some of the modern techniques that are used to achieve this miraculous success are development of monoclonal antibodies, genetic engineering and hybridoma technology.[3]

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Address for Correspondence:

Dr Tehseen Iqbal, Secretary General, Pakistan Physiological Society, Professor & HoD Physiology, Ghazi Khan Medical College, DG Khan, Pakistan. **Cell:** +92-333-6144799

Email: prof.tehseeniqbal@gmail.com