EFFECT OF STRESS ON IMMUNITY

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ABSTRACT: Immunological system is part of the complex component kapha of Ayurveda. Composed of an array of constituents, it acts as the internal surveillance system of the body. Diseases appear when immunity is compromised. This paper describes in detail the effect of stress on immunity.

INTRODUCTION

Immunity is the ability of a living organism to resist infection when brought in direct contact with the causative agent of a particular disease. Immunity of an animal depends on the presence in the blood of specific substance which are either and expression of constitutional characteristics of the organism or are the result of reaction of the latter to previous infection. Thus the ability to detect and destroy completely anything that is foreign to body is the prime function of immune system which plays, its defence mechanism via an intricate regulation of cellular and humoral factors.

The immunological effector cells can be divided into phagocytic and lymphocytic cells. The phagocytes include eosinophils, neutrophils, basophils and macrophages which circulate as monocytes, then migrate out of the vascular space to become tissue macrophages. Lymphocytic cells are classified according to their site of maturation. Lymphocytes which mature in the thymus gland are referred to as T-lymphocytes; whereas those which mature in the other tissue are classified as B-lymphocytes. Several subclasses of T-lymphocytes have been identified. T-helper, T-helper, T-suppressor, T-cytotoxic and T-contrasuppressor cells. Another class of lymphocytes are natural killer (NK) cells which may be important in immunological surveillance against neoplasia. In addition, a large number of humoral or soluble chemical s participate in the immune response.

Antibodies are glycoproteins which identify non-self material, the cascade system of proteases of a complement system destroys such material. Tumor necrosis factor (TNF) is secreted by macrophages causing haemorrhagic necrosis of neoplastic tissue. A multitude of biological response modifiers regulate and coordinate the different parts of the immune system to produce their desirable effect. These include monokines derived from circulating monocytes or tissue macrophages (interleukin-1 which causes activated T-lymphocytes to divide) and lymphokines derived from lymphocytes (interleukin-2 which causes activated T-cells to proliferate and induces cytotoxic T-cell reactivity).

IMMUNOMODULATION

An immunomodulation can be defined as a biological or non-biological substance that...
directly influences a specific immune function or modifies one or more components of the immuno-regulatory network to achieve an indirect effect on a specific immune function.

The depression of the immune system associated with cancer, surgery or drugs is characterized by a reduction in the number and phagocytic function of neutrophils and macrophages, as well as a reduction in the intra-cellular bactericidal capacity of these cells. The T-cell function is also diminished. The profound suppression of the individual elements of the immune system allows opportunistic pathogens to overwhelm the host so that secondary infections become the most common cause of mortality in such individual. Also, physical or psychological stress causes immunosuppression and hence makes an individual susceptible to infections. The immunostimulant drugs like BCG, Corynebacterium parvum, muramyl depeptide, glucans, interleukin-1 and colony stimulating factor (CSF) are used in such diseased condition to boost non-specific host resistance against infections.

The immunosuppressor like azothioprine, cyclophsphaamidie, prostaglandins, cyclosporine A, thiocarbomate etc are used in conditions of immunohyperesensitivity reactions in the body, as exemplified in situations of asthma, autoimmunity graft rejection arthritis, allergy and inflammatory disorders.

Thus immunostimulation and immunosuppression both need to be tackled in order to regulate the normal immunological functioning.

**Effect of stress on immune system**

Stress, be it due to physical or biological stressor and whether its origin is in an inwardly psychiatric illness or due to an external stressor, is now reported to be associated with immunosuppression.

Recent studies reveal that the hormones possess significant impact on the immune system in general through specific receptor for these neuroendocrine factors in immuno-competent cells which include ACTH, prolactine, growth hormones, steroid hormones, catecholamines and acetylcholine. In addition opioid receptors have been found on lymphocytes granulocytes, monocytes, platelets and on terminal complexes of complement. The interaction between neuroendocrine factors and their receptors immunocompetent cells could alter cellular activity through the activation of a variety of secondary messengers like CAMP and CGMP. The immunomodulatory effect of these factors may be similar to those that regulate neuroendocrine function and involves the initiation or modulation of certain biochemical events required for cell proliferation, differentiation and function and involves the initiation or modulation of certain biochemical events required for cell proliferation, differentiation and function.

Neuroendocrine factors may also modulate the immune response indirectly by affecting the production or activity of lymphokines and monokines. It is well established in fact that stress causes alteration in the equilibrium of various hormones. Immune system interacts intimately with nervous and endocrine systems. It has been suggested that the immune system should be viewed as an internal sensory organ that recognizes non-cognitive stimuli such as bacteria, viruses and other antigens and relays information to the neuroendocrine system via lymphocyte derived hormones, blalock et al have suggested that the
immune system may produce many and perhaps all, of known neuroendocrine peptide hormones experimentally induced stress in animals is associated not only with adrenocortical hypersecretion but also with lymphocyte depletion thymic involution and decrease in spleen and lymph node tissue mass\textsuperscript{22,23}.

The studies on the immunological effects of examination stress\textsuperscript{24-26} revealed a reduced mitogen induced lymphocyte proliferation, higher anxiety and reduced expression of interleukin-2 receptors. There was decline in N.K activity\textsuperscript{27} and lowered ability of the cellular immune response to control latent herpes viruses\textsuperscript{28,29}. The extended space flight is another long term physical stressor, which was found to depress the lymphocyte proliferative response to control latent herpes viruses\textsuperscript{28,29}. The extended space flight is another long term physical stressor, which was found to depress the lymphocyte proliferative response to mitogens and reduce the circulating T-lymphocytes. Similar decreased phagocytic activity and decreased blastogenic response were observed in a 77 hour sleep deprivation stress experiment.

In the past decade, researchers have begun to map out the cognitive, emotional, physiological and behavioroural aspects of stress with immunity. Mood disorders and a range of stressful life events rising from academic stress, unemployment, bereavement and separation\textsuperscript{34} have been associated with decrease in measures of immuno-competence.

In the studies to evaluate the effect of stress on immunity, methodoligical problems such as the type of stress, its timing and duration how interact with subject variable such as sex, age, animal strain and immune parameter being measured, becomes important. It has been observed that uncontrollable stress, for e.g inescapable shock, has a far greater effect on immune function than controllable, an escapable shock stress\textsuperscript{35}. Thus, availability of ‘coping’ response is critical. The pattern of adaptation to repeated stress is also crucial. In this regard, it has been observed that acute stress and chronic stress\textsuperscript{36} in which adaptation to the stress does not develop lead to depletion of norepinephrine (NE)and dopamine (DA) in some brain regions with increased levels of acetylcholine (Ach) and some hypothalampituitary – Adrenal axis hormones such as ACTH, B endorphin and corticosteroids. These changes are associated with immune suppression and enhanced tumor development in a variety of animal models. Conversely, changes are associated with immune suppression and enhanced tumor development in a variety of animal models. Conversely, chronic stress paradigms in which animals show adaption to the stress, most often lead to enhanced synthesis of NE and DA and a concomitant decrease from the acute levels of ach and other HPA axis hormones towards baseline this adaptation or ability to effectively Cope’ generally leads to enhanced immune function and deceleration of tumor growth.

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