

Chiropractic and the Neuroimmune Connection

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ABSTRACT

Objective: To review the literature on the connections between the nervous and the immune systems, and to explore the contention that chiropractic adjustments may affect neuroimmune function.

Data Collection: Relevant articles in English were retrieved through a search of MEDLINE and the Index to Chiropractic Literature. Key search terms included: chiropractic, immune system, nervous system, sympathetic nervous system.

Articles were included if they discussed or tested the chemical or neurological links between the nervous system and the immune system and/or discussed the effect of chiropractic adjustments on immune function and general health.

Results: There appear to be numerous modes of communication between the nervous system and the immune system. It also appears, not only in theory but in practice, that chiropractic adjustments may have a beneficial effect on the functioning of both the nervous and the immune system.

Conclusion: For many years chiropractors have claimed that spinal adjustments can help improve the overall health of an individual. There is a growing body of scientific research to support this contention.

Key Words: *Chiropractic, Neuroimmune, Sympathetic Nervous System, Immune system*

Introduction

A person's body repairs damage, fights or prevents infection and destroys cancerous cells through the activity of the immune system. For a number of years researchers and neuroimmunologists have described the immune system as a continuation of the nervous system and stated that immune cells are simply the effector cells for the nervous system. These claims have been made based on the fact that the nervous system plays such a crucial roll in alerting and guiding immune system cells to where damage or an infection is located.

The nervous system is also responsible for localizing the immune response to the specific site of damage or infection. Localization of immune activity prevents a systemic or a greater immune response than the body needs. The body has the ability to heal itself and chiropractic theory postulates that when the nervous system is free from disturbance (subluxation free) the body can respond more effectively resulting in improved overall health.

The immune system is responsible for all repair in the body. It is primarily made up of two sub-systems, innate and adaptive.¹ The adaptive part recognizes and attacks invading microbes (viruses and bacteria) while the innate system functions by engulfing foreign objects or injecting microbes with poisons. The innate system functions as the first line of defense and reacts immediately. The adaptive system works by teaming B cells, T cells, and antibodies to overwhelm the invading antigen (bacteria, virus or foreign object) and is able to store a "fingerprint" of the invader for faster recognition in the future. The innate system produces interferon, a chemical that blocks viral replication and sends a warning to the adaptive immune system. Interferon is one of many chemical messengers that is sent between the two systems.¹ Although scientists have known about the nervous system's role in regulating the immune system for years, this concept has finally come to the forefront of scientific research.²⁻⁵

Recently the focus of science has shifted from viewing the nervous and immune systems as separate entities to

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recognizing that the brain utilizes specific pathways to the immune system for the purposes of guiding, controlling and modulating the immune response.^{2,6-8} There is bi-directional communication between the nervous system and immune system.⁶⁻⁹ Neuromodulators, chemical messengers of the nervous system, are released by nerves to guide immune function.^{2,6,10-13} The immune system communicates its status back to the nervous system by white blood cells' secreting chemical messengers called cytokines, a type of neuropeptide -- chemicals released by cells to communicate with the nervous system.^{2,6,14-18} When the immune system is activated, immune cells also send out an array of specific chemicals, immunomodulators, to influence the function of the nervous system.⁷

These immunomodulators reach specific target areas in the brain, where they induce various recuperative and protective behaviors such as shivering, sleepiness and a reduced propensity to fight attackers.¹⁹ When people take a couple of aspirin or acetaminophen for pain and fever they may end up battling the sickness even longer because they are stopping these productive processes to feel better. Studies suggest that anti-fever therapy prolongs illness by stopping the body from inducing its natural defenses. These chemical pathways of communication are only a few of the many routes of communication that the nervous system and the immune system employ.

Review of Literature

Channels of Communication

There are multiple channels of communication between the brain and the immune system.^{2,6,7,20,21} Numerous scientific and medical studies have demonstrated direct nerve supply to the immune system.^{6,22-26} It has been shown that there is direct contact between nerves and lymphocytes (immune cells that kill viruses and tumor cells) in the spleen and thymus gland (the gland that develops and programs immune cells to attack foreign objects).^{2,6,7,20,21} Altered nerve activity to the spleen has been found to diminish immune responses including the ability of natural killer cells to target and destroy viruses and cancer cells.^{6,7,27}

As far back as 1945 it was demonstrated that the bone marrow has an extensive nerve supply.³ The nerve supply to the bone marrow is a direct link from the nervous system to lymphocytes and the immature cells that will eventually become red blood cells and white blood cells.^{2,6,23,28} Nerve stimulation to the bone marrow causes an activation of the immune response by releasing the immune cells into the general circulation.^{6,29}

Immunity

The lymphatic system also plays a major role in immunity.¹⁹ All lymphoid organs including lymph nodes, spleen, etc., have a direct nerve supply for the purpose of modulating the immune response.^{6,29} Disturbances in the nervous system have been shown to alter the immune response and the function of these immune cells, specifically lymphocytes.²⁰ Lymphocyte migration to an area are controlled by the central nervous system (CNS).⁶ Due to the heavy nerve supply of the thymus

gland, the nervous system is thought to play a major role in the development of immune cells.⁶

The thymus gland is responsible for developing thymocytes to T-cells and for producing surface proteins which act as signal transducers for cell differentiation and proliferation.⁶ Dysfunction in the nervous system can not only slow the immune process but it can also result in overreactions or hypersensitivities, such as allergies for example.

Allergy

Allergies are an inappropriate immune response to a substance that is not harmful to the body. The sympathetic nervous system causes immune responses to be fast and localized, mobilizing mainly lymphocytes and granulocytes (neutrophils, basophils and eosinophils).⁶ These cells kill bacteria, viruses and parasitic worms, produce antibodies, destroy cancer cells, release chemicals to attract more immune cells and alert the nervous system that there is something wrong, and inhibit allergic reactions.³³

Eosinophils lessen the severity of allergies by phagocytizing antigen-antibody complexes (substances that are harmful or perceived to be harmful, which antibodies have bound for the purpose of deactivating the substance) and by inactivating certain inflammatory chemicals released during an allergic reaction.³³ These cells also inactivate the inflammatory response (immune response) when it is no longer needed.

A very powerful neurotransmitter called substance P which is approximately 100-400 times more potent than histamine in eliciting symptoms may play a role in this over reaction of the body.³⁰ Substance P is transported through specific types of nerves and is released in response to dangerous or noxious mechanical, thermal and chemical stimuli, to elicit the appropriate defense reaction from the body.² Many allergic conditions may be at least partly due to some type of nervous system dysfunction resulting in inappropriate release of substance P.

Immune System as Sensory Organ

It has also been suggested that the immune system acts as a sensory organ, like the eyes or ears, only spread out over the whole body and transmitting information to the nervous system that is just as crucial in guiding a person's actions but much less distinct than sight or hearing.^{4-6,16,31,32} The immune system acts as a network of specialized biosensors designed to pick up information from within and around the body and relay that information to the brain. This causes animals or people to behave in specific ways to promote healing or to guide reactions in the interest of self-preservation.^{4,5} The activation of these functions can be altered by stress.^{4,5}

Stress

Stress plays a major role in many illnesses and can cause alterations in the immune response.^{4,5} One of the reasons that stress has such a harmful effect on health is that certain types of immune cells responsible for attacking microbes (bacteria, viruses, fungi, etc.) are sensitive to certain brain chemicals such as stress hormones (cortisol, adrenaline, etc.), and will

become inactive when they come into contact with these chemicals. When stress hormones are released they can slow the immune response, which would explain why the immune system suffers in people under chronic stress.^{4,5}

The part of the nervous system responsible for releasing these types of chemicals and guiding the stress response is the sympathetic nervous system.³³ The sympathetic nervous system is responsible for activating the “fight or flight” response, which causes specific changes to occur throughout the body in response to dangerous situations. These changes include: opening up the airways in the lungs, increasing heart rate, sending blood to the muscles, sweat glands, eyes and the lower part of the brain to activate “instinct like” responses. Blood is moved away from the digestive tract and the other internal organs.

Whenever the body comes into contact with a harmful stimulus there is an increase in activity of the sympathetic nervous system, while non-harmful stimuli generally decrease sympathetic activity.^{34,35} These changes in sympathetic activity can be quantified by measuring changes in heart rate, blood pressure and other stress induced responses.^{34,35} Altered regulation of the sympathetic nervous system may be associated with the immunological abnormalities seen in chronic stress, clinical depression, and aging.³⁶ However, the nervous and immune system responses are not only guided by stimuli being good or bad, they also depend on the frequency of stimulation.^{34,37} This means that to attain correction in the nervous system, any treatment being utilized would have to be administered on a regular basis.³⁷

The Role of the Chiropractic Adjustment

Nervous system dysfunction can cause immune system dysfunction, and chiropractic theory postulates that by removing the nervous system interference, spinal adjustments can help correct immune system dysfunction.² Poor movement in the spine can adversely affect the immune response by causing the body to incorrectly activate a stress response, which slows the ability of the immune system to react.^{2,4,5,34}

Subluxations are disturbances in the nervous system, which can cause increased or decreased activity of the sympathetic nervous system.²⁴ A disturbance in the nervous system can affect the body in two different ways.³⁷ One reaction the nervous system can have is to become hyperactive--the nervous system may bombard the periphery with excessive chemical messages that drastically alter the local homeostasis, causing abnormal changes in growth and activity.³⁷ When the sympathetic nervous system is hyperactive over long periods of time it will tend to produce the development of abnormal conditions and disease processes in the organs or tissues to which it supplies information.^{22,37}

A second way that a disturbance in the nervous system can affect the body occurs when the nervous system becomes hypoactive; cells that are normally controlled and suppressed begin working out of control, which in some cases is hypothesized to lead to cancer.³⁷ All cells are equipped with all the necessary genes to allow them to differentiate (reproduce), and with proper nervous system function only the appropriate set of genes is activated.³⁷

Cancer cells are cells that are growing and functioning out of control because the wrong set of genes has been turned and left on because the nervous system has failed to suppress them.³⁷ Long term changes in the nervous system have also been shown to be mitigating factors in many disorders including autoimmune diseases, cancer, fibromyalgia and chronic fatigue syndrome.^{6,34,37}

The contention is that when the disturbance in the nervous system is corrected and the abnormal activities are eliminated, homeostasis in the periphery can be re-established and the process of disease will be eliminated.³⁷ An abnormally functioning nerve which is either hyperactive or hypoactive tends to return to normal function upon proper stimulation.³⁷ However, it is crucial that corrections (adjustments) are given at a frequent interval in order for the normalization to take hold to cause a permanent correction.³⁷ Chiropractic adjustments correct subluxations which are disturbances in the nervous system.^{2,37,39}

Vertebral subluxations are caused by an overload of either a physical, emotional or chemical stress.⁴⁰ When these types of stress exceed the limits of the body's ability to adapt, a cascade is initiated which leads to subluxation. Subluxations cause disturbances in the nervous system by initiating this sequence of events: 1) misalignment and/or abnormal motion of the vertebrae, 2) narrowing of the intervertebral foramina and/or irritation of neurological tissue, 3) subsequent tissue or fluid-related pressure on the nerve root, and 4) a resulting interference to the “flow of mental impulses”.⁴⁰ Spinal adjustments are believed to correct the subluxations and eliminate these adverse effects.^{2,37}

Studies that have measured the effect of chiropractic adjustments on the immune system have shown that chiropractic can influence T and B lymphocyte counts, NK (natural killer) cell numbers, antibody levels, phagocytic activity and plasma beta-endorphin levels.⁴¹ In one study the effect of specific spinal adjustments on the immune system was measured by looking at CD4 cell counts of HIV positive individuals as measured by CD4/mm3 in the blood.²² The CD4 cells, or T-helper cells, are the immune cells that are attacked in HIV patients.²² The blood tests used in this study were performed by each patient's independent medical center where they were under medical supervision for the condition.

Both of the control groups, one receiving placebo adjustments the other receiving no adjustments, each experienced about an 8% decrease in CD4 cell counts over a six month period, while the group receiving real chiropractic adjustments experienced a 48% increase in CD4 cell levels over a period of six months. Although chiropractic adjustments helped to greatly improve the ability of seriously ill people with HIV to fight disease, other studies have shown that it should not be restricted to the sick.⁴²

Adjustment's Reparation of Cellular Damage

One study observed the effect that chiropractic adjustments have on a person's ability to repair cellular damage and genetic mutations.⁴² Three groups of people were compared: people who had been receiving long term chiropractic care, normal individuals who were deemed to be healthy, and

seriously ill individuals. All three groups were screened with battery of tests to make sure there were no other factors influencing their health such as genetic predispositions, nutrition, exercise, etc.

Particular scrutiny was given to the chiropractic group to see if there was any reason why they would have increased resistance or decreased susceptibility to disease and they were found to be perfectly normal.

Blood tests were performed on all of the groups for an enzyme that is very important in removing hazardous agents, using a battery of tests called GTTSBO. Blood tests were also performed to measure DNA repair by measuring unscheduled DNA synthesis and an enzyme called adenosine diphosphate ribosyl transferase (ADPRT).

Measuring these enzymes measures the person's ability to develop resistance to hazardous environmental exposures and oxidative stress. When these enzymes are suppressed it limits a person's life span and the person's ability to resist serious diseases.

The normal healthy individuals had roughly twofold enzyme levels compared to the seriously ill group. However, the chiropractic patients had a twofold higher enzyme level compared to the normal healthy patients, and had a fourfold higher enzyme level than the ill group.

Immune competence is also known to substantially decrease with age.⁴² Expert immunologists determined that in the 96 chiropractic patients ages 21-87 there was no decrease whatsoever in immune competency. The only difference between the normal healthy people and the chiropractic group was that the people in the chiropractic group were under long-term chiropractic care (over six months of regular adjustments).

This suggests that chiropractic could potentially optimize whatever genetic abilities these people have, so that they now can fully express immune function, which the normal individuals or diseased individuals cannot. This study used peripheral blood samples to demonstrate that the nervous system and the immune system may play a great role in the regulation of disease. The researchers stated that these changes occurred due to chiropractic care, not dietary intervention or any other factors. They also stated that there is nothing else that seems to elicit these results. These changes can be initiated at any age and people can have these benefits as long as they choose.

Proactive Care

Unfortunately the way in which many people care for themselves is reactive.⁴³ They will wait until a health problem arises before taking any actions to improve their health. Many health issues could be avoided if people took a more proactive stance on health decisions and started to take care of themselves or their children earlier in life. Children raised under chiropractic care were less prone to infectious processes such as otitis media (ear infections) and tonsillitis, for example.⁴⁴ These children had stronger immune systems and were also better able to cope with allergens such as pollen,

weeds, grasses, etc. as compared to children raised under allopathic care.

There is also a significant decrease in antibiotic therapy use among children receiving chiropractic care.⁴⁴ A Penn State University study of 654 Americans published in the Journal of Social Science and Medicine stated that persons with childhood health problems were twice as likely to develop cancer or chronic lung disease by late middle age.⁴⁵ Arthritis was about 33% higher in this group. A childhood of ill health may be parent to a full gamut of adult illnesses.⁴⁶

It is believed that chiropractic stimulates the immune system to combat infectious processes and not only helps sick people get well but helps healthy people become much healthier.^{42,44}

Conclusion

The nervous system and the immune system have such a multitude of connections that they could correctly be referred to as a single system. The nervous system senses damage, infectious agents and foreign bodies with the help of chemical releasing immune cells and deals with these problems by deploying different types of immune cells to carry out specific procedures. Disturbances in the nervous system (subluxations) diminish the ability of an individual to sense and repair damage and combat infection, cancer etc. directly, resulting in diminished health.

Research is accumulating which supports the aforementioned contentions regarding the relationship between vertebral subluxation, chiropractic adjustments and improved nervous and immune system function. However, much more needs to be done and the profession is encouraged to take a much more proactive approach towards research agenda that explores these issues more aggressively and critically.

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