Fibromyalgia and the Sympathetic Nervous System

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In the Dec. 3, 2001 issue of ADVANCE, ("Fibromyalgia: A New Paradigm for Its Origins and Treatment") fibromyalgia was described as a syndrome that results from neuromuscular and connective tissue stress and that reflects a decreased adaptability of the autonomic nervous system. This view stands in contrast to the predominant focus of recent research on fibromyalgia, which has aimed unsuccessfully at identifying a single biochemical agent responsible for the syndrome.

The authors view fibromyalgia as a systemic response to autonomic nervous system imbalance, an imbalance that is reflected in long-term sympathetic nervous system arousal or chronic stress. This stress may in turn correspond to and even be triggered by reactive emotions such as fear, anxiety or anger, when these emotions are of long-term duration.

This article elaborates on how hyper-arousal of the sympathetic nervous system caused by mental and emotional stress, and biochemical changes that accompany this activation of the sympathetic nervous system, can result in symptoms typical of fibromyalgia: excessive neuromuscular tonus, chronic fatigue, cold hands and feet, sleep disorders, irritable bowel, connective tissue inflammation and other symptoms and addresses the implications of this analysis for treatment.

The Autonomic Nervous System

It is the autonomic nervous system that is principally responsible for the physiological activation that occurs during a stress response. But how does a "stress message" of fear, anxiety or anger get relayed from the conscious mind, which resides in the cerebral cortex or upper part of the brain, to the subcortical areas of the brain which govern vital bodily functions and operate as the basic control centers for the autonomic or involuntary nervous system? While this process is extremely complex, two structures of the brain do seem to be particularly important.

The first structure is the reticular activating system, a network of nerves that transmits messages through neurological channels between the cortex and the subcortex, providing for a dialogue between the autonomic processes and the centers of thought in the cerebral cortex. The reticular activating system carries messages from the cerebral cortex to the organs and muscles and also relays stimuli received at the muscular and organic levels back to the higher awareness centers. In other words, the reticular activating system plays a key role in the communication between mind and body, and it offers a physiological explanation for how messages can be transmitted directly from the conscious mind to non-conscious parts of the brain and to organs and muscles.

The second structure is the hypothalamus, located in a part of the subcortex known as the diencephalon. The hypothalamus is closely connected with the brain's limbic structures, which are concerned with various aspects of emotions. It is strongly influenced by the limbic system and the reticular activating system. The primary activator of the autonomic nervous system, the hypothalamus also plays a pivotal role in translating neurological stimuli into endocrine processes.

When the hypothalamus signals "Stress!" the autonomic nervous system reacts by automatically initiating a complex series of physiological and biochemical changes. Called the "involuntary system" because it controls internal functions such as gastrointestinal, vascular and reproductive activities, the autonomic nervous system has two interdependent parts. The sympathetic nervous system, which originates in the cervical, thoracic and lumbar nerves, is the system that is primarily activated during periods of stress. It is responsible for tensing and constricting involuntary muscles and activating the endocrine system. In contrast, the parasympathetic system, which originates in the cranial and sacral nerves, is most pronounced during rest. It allows for the dilation of smooth muscles and helps to induce a state of relaxation.
Strong activation of the sympathetic nervous system is known as the "fight or flight response." Many of the symptoms of the fight or flight response are characteristic of fibromyalgia. These include contraction of the musculature throughout the body, but most particularly in the upper back, diaphragm, pelvis and legs; cold hands and feet due to contraction of blood vessels and gastrointestinal problems, due to blood shifting away from the digestive centers of the body.

The sympathetic nervous system works in close coordination with the endocrine system, much of this coordination being regulated through the hypothalamus. The first stage of endocrine stimulation involves primarily the release of adrenalin and noradrenalin from the medulla of the adrenal glands. The second, more prolonged endocrine activation in response to stress involves the hypothalamus in releasing the hormone corticotrophin to activate the pituitary gland. The close connection between the hypothalamus and pituitary is especially important, since the pituitary is the master endocrine gland and it governs the activities of all the other endocrine glands of the body.

Under stimulation from the hypothalamus, the pituitary releases adrenocorticotrophic hormone (ACTH). ACTH in turn stimulates the adrenal cortex to release glucocorticoids, which inhibit inflammation, and mineralocorticoids, which promote inflammation. The pituitary also controls the release of the thyrotrophic hormone, which causes the thyroid gland to secrete thyroxine. Long-term stress, and hence long-term production of thyroxine, can result in chronic fatigue and sleep disturbances, both of which are characteristic of fibromyalgia. Chronic fatigue might also be a natural consequence of prolonged stimulation of the adrenal glands. Similarly, an imbalance in corticoid production may be related to the chronic pain characteristics to fibromyalgia. Finally, prolonged presence in the body of pro- and anti-inflammatory corticoids can interfere with the immunological functions of the body, making it more prone to the infections and autoimmune problems that characterize some fibromyalgia patients experience.

In short, the combination of autonomic nervous system and endocrine changes stimulated by prolonged stress may result in many of the symptoms typical of fibromyalgia. It is therefore reasonable to suppose that in a substantial number of cases, teaching patients how to reduce sympathetic nervous system arousal could result in improvement of symptoms.

References available online at www.advanceforPT.com. Select "References" on the left menu bar.

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Treating Fibromyalgia Through Self-management of Stress

Physical therapists and other professionals can help patients take a more proactive and informed stance about their condition, and learn to decrease exacerbating reactions to stress, anxiety or pain.

When pain and fatigue become an everyday experience and patients have no idea what caused this then they can feel controlled by their disability. This reaction can worsen pain by encouraging feelings of anxiety and helplessness, all of which only exacerbate stress and therefore aggravate symptoms. Educating patients about the dynamics of the sympathetic nervous system can encourage them to deal more proactively with their pain, especially if they understand that anxiety is not just a response to pain but also a contributor to it. In particular, this education can motivate them to learn and apply self-management skills.

1. Physical self-awareness techniques for enhancing control over the autonomic nervous system. Physical self-awareness techniques can teach patients how to gain conscious control over what had for them been involuntary physiological processes. This shifts them out of sympathetic nervous system hyper-arousal, while reducing reactive emotional and mental stress. Physically based self-awareness techniques include:

   a) Meditative breath awareness and related relaxation techniques. Meditation is widely recognized as an effective tool for promoting a relaxation response. In our view, the system of meditation most likely to be
useful to fibromyalgia patients is Vipassana, the form of meditation traditionally associated with a nonjudgmental awareness of the breath. Particularly when combined with training in easy, deep breathing, the regular practice of Vipassana meditation tends to inhibit and reverse the shortened breathing and rigid diaphragmatic patterns characteristic of sympathetic nervous system arousal. In addition, once patients become more aware through meditation of how to breathe in a deep, relaxed manner, they can begin to integrate relaxed diaphragmatic breathing into everyday activities. This kind of breath work simultaneously stimulates both a physiological and an emotional relaxation response. The soft focus, breathing and gentle movement of t'ai chi can also assist in this kind of self-awareness, as can yoga postures when they include breath awareness.4

b) Techniques for recognizing and releasing involuntary muscle tension. Two forms of movement therapy, Feldenkrais5 and Alexander Technique6, train clients to recognize and inhibit previously unnoticed and involuntary muscle contractions. The resulting physiological relaxation contributes directly to reducing pain, to cutting short the biochemical aspects of the stress reaction, and to enhancing emotional and mental well-being.

2. Mental techniques for personal empowerment. Since stress is often related to reactive emotions that express feelings of disempowerment of being controlled by the world instead of being in control of one's life, encouraging a client to pursue mental and emotional strategies for empowerment can help the healing process. These strategies may best be explored through the help of a mental health professional. They include:

a) Developing appropriate boundaries. Patients under chronic stress often have poor psychological boundaries. They say "yes" when they should say "no" and often have difficulty negotiating win-win situations. A trained psychologist or counselor can help a client identify and challenge these boundary problems.

b) Noticing and changing negative thought patterns. The difference between a client who can improve and one who cannot may be as simple as the difference between a person who says, for example, "I can't do any exercise today, because I am afraid it will hurt," and the one who says, "I am going to find a way to exercise, even if it hurts, so that I can strengthen myself and my self-confidence." Helping patients identify how they talk to themselves can either undercut or support their progress. Specific tools for heightening awareness of and control over negative thought patterns are taught by neurolinguistic programming7 and by mindfulness-based approaches.8

c) Using visualization. For a number of years, visualization has been recognized as an effective tool for altering the body's response patterns.9 Patients with chronic pain can be unconsciously committed to their pain, anticipating it even before it hits. This in turn aggravates the stress reaction, ensuring a negative outcome. Using visualization to project positive outcomes can help break this self-defeating cycle.

3. Physical empowerment strategies. A sense of physical strength and endurance can contribute in marked ways to personal self-confidence. Participating under the guidance of a professional in an exercise routine that gradually develops strength and flexibility, and incorporates a cardiovascular program, not only releases endorphins and activates a physiological healing response. It also contributes to a feeling of "I can make it," an ability to conquer the odds. For both its physical benefits and its emotional payback, regular exercise is key in conquering stress and the pain of fibromyalgia.

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