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Chronic Hyperventilation: Hypocapnia and Psychophysiological Dysregulation

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Abstract

Anxiety is a normal emotion. Modern world is full of events that may create anxiety and all of us may experience emotional stress on a time-to-time basis in our activities of daily living. Some people's anxiety reaction becomes much more extreme and can happen during normal, daily activities. This is called an anxiety disorder. Anxiety disorder can have a profound negative impact on those who experience it. It can also have a negative impact on loved ones and colleagues.

The emotional stress is frequently accompanied by specific physical symptoms. Mild form of psychosomatic illness is overlooked by society. Problem is that the sufferers recurrently seek medical advice without a satisfactory outcome. And thus the healthcare system is overburdened.

Anxiety can affect your breathing. On the other hand, your breathing can affect feelings of anxiety. Often, panic and hyperventilation become a vicious cycle—panic leads to rapid breathing while breathing rapidly can make you feel panicked.

The hyperventilation syndrome is generally considered as an acute attack of over-breathing during the stressful situations of daily living. These spells of hyperventilation can be easily recognized. While chronic hyperventilation is more common and the sufferer is unaware of the fact that he is over-breathing." Problem is that the patients with chronic hyperventilation syndrome are difficult to diagnose. Medical research studies show that over 90% of modern people (so-called "normal subjects") are hyperventilators.

Since the partial pressure of oxygen in the alveoli is dependent on the carbon dioxide concentration of blood and lungs. Hence optimum levels of carbon dioxide in the blood and alveolar air is a precondition for proper gas exchange and normal health. Many physicians are not aware of the fact that for some people, even slight changes in carbon dioxide balance in the brain may be linked with psychiatric conditions. Hyperventilation occurs when a person over-breathes. It removes too much CO_2, raising the blood pH above normal, and causes physical symptoms.

Current research shows that chronic hyperventilation has been linked with a wide array of anxiety disorders and physical symptoms. Apart from general practice, patients with hyperventilation syndrome are often initially seen in emergency rooms, cardiology departments and neurology clinics, only to be eventually referred to psychiatrists. Hyperventilation syndrome is an area of medicine under current study.

Keywords Anxiety; Hyperventilation; Carbon dioxide; Breathing therapy

Introduction

Dysfunctional breathing/hyperventilation syndrome (DB/HVS) is a breathing problem that involves breathing too deeply and/or too rapidly (hyperventilation) [1].

Hyperventilation is the result of an increase in minute ventilation, when carbon dioxide, as a volatile acid, is blown off quickly causing a decrease in alveolar concentration below its normal levels [2].

Hypocapnia is a condition of reduced blood carbon dioxide concentrations. Then anxiety can manifest as a consequence of cerebral vasoconstriction. As a result of a rise in pH of the blood, there is also an increase in neuromuscular irritability [3].

As a result of metabolic processes, our body produces H+ ions on a daily basis, which, in turn, decreases the pH of the blood. Since body always tries to maintain acid-base balance within narrow limits, any fluctuations beyond this range may cause harmful effects [4]. Carbon dioxide is a guardian of the pH of the blood, which is essential for survival [5].

Hyperventilation removes too much CO_2, raising the blood pH above normal, and causes physical symptoms [6]. Most people have experienced short episodes of acute over breathing during stressful or frightening events [7]. The hyperventilation syndrome is usually easily recognized when it follows an acute form. It is often overlooked, however, when it follows a chronic and insidious course [8].

Hyperventilation and Anxiety—A Vicious Cycle

The concept of hyperventilation and the principle of a vicious circle

provide an elegant explanation for the development of a wide range of somatic and psychological symptoms [9]. Anxiety encourages over-breathing and over-breathing encourages anxiety [10].

According to a recent study of Finnish scientists from the Laboratory of Neurology of the University of Joensuu, hyperventilation "leads to spontaneous and asynchronous firing of cortical neurons" (Huttunen et. al, 1999) [11].

Hyperventilation has been linked to emotional distress in adults [12]. Anxiety disorder can have a profound negative impact on those who experience it. It can also have a negative impact on loved ones and colleagues – people who are close to and/or work with someone who is experiencing anxiety disorders [13].

As we are living in the age of anxiety. Mental health problems including anxiety is rampant in the modern society [14]. According to one estimate about 18 per cent Americans are suffering from mental and emotional stress. Even more important, patients complain that their problem is often overlooked by the public and main stream health professionals alike [15].

It is therefore really important for anyone supporting a sufferer of an anxiety disorder to seek appropriate help and also to gain as much information as possible about anxiety disorders [16].

Special focus:

Current research shows that chronic hyperventilation precedes and has been linked with a wide array of anxiety disorders and physical symptoms [17].

Hyperventilation—Clinical Implications

The major clinical manifestations of hyperventilation syndrome include one or more of the following symptoms: [9,18]

- Breathlessness
- Anxiety, feeling of panic
- Numbness and tingling (paresthesias)
- Musculoskeletal pains
- Palpitation
- Weakness, exhaustion

Magnitude of the Problem

Various clinical trials have been conducted to know the prevalence of hyperventilation in the subjects that are found to be normal according to the medical norms. These studies show that about 90 per cent of the normal population in the contemporary societies, people are hyperventilators. Therefore, it could be concluded that hypocapnia (decreased blood carbon dioxide concentration) is quite prevalent among the modern living people" [19].

"Since the diagnosis of hyperventilation in people who do not show any organic cause, is very difficult. Once definitive diagnosis is made, it is possible to treat the majority of these patients with the help of both the drugs and simple therapeutic exercises" [20].

Good news is that controlling the breath is an effective measure to counteract the ill effects of hyperventilation in patients suffering from anxiety attacks [2].

Many Benefits of the Therapeutic Increase of CO_2

Carbon dioxide is essential for life and health. Its lack or deficiency is of itself a starting point for different disturbances in the body. Carbon dioxide should be maintained at an optimum level in the blood. Most doctors have never heard of carbon dioxide therapy. Yoga or deep breathing exercises actually increase CO_2 levels and this is good [21].

Low carbon dioxide causes stress on all the body's organ systems--"The theory of life, in brief, is such that carbon dioxide acts as the regulator of all functions in the organism, it maintains the internal environment of the organism [22].

Since the partial pressure of oxygen in the alveoli is dependent on the carbon dioxide concentration of blood and lungs. Hence optimum levels of carbon dioxide in the blood and alveolar air is a precondition for proper gas exchange and normal health. There are many benefits of carbon dioxide are as follows: [12,19,23].

- Since therapeutic increase of carbon dioxide dilates the capillaries and decreases the pH of the blood. Both of these effects increase the bio-availability of oxygen to the tissues.
- Because of the narcotic effect of carbon dioxide, it decreases the excitability of nerves and muscles resulting into a calming effect on the body and the mind.
- Carbon dioxide dilates bronchi and bronchioles.
- Carbon dioxide is the main controller of the acid-base balance of the blood and body fluids.
- Carbon dioxide is not always a final waste product. It may be utilized, as a nutrient, in the molecular building of the material

In conclusion, carbon dioxide brings favorable effects on the body and the mind by its tonic influence over the nerves, respiration, and cardiovascular system [23].

Breathing Therapy: Chronic Hyperventilation

The emotional stress and hyperventilation is frequently accompanied by specific physical symptoms. Mild form of psychosomatic illness is overlooked by society. Problem is that the sufferers recurrently seek medical advice without a satisfactory outcome. And thus the healthcare system is overburdened." Yogic breathing exercises have long been practiced for rehabilitation and prevention of illnesses. It has been claimed that the practice of yoga can heal any disease condition, provided that we practice it regularly [24].

In spite of the above claims, it is surprising that physicians working in mainstream psychiatric settings have not yet realized the importance of breathing therapy [25].

Breathing therapy generally aims to either correct dysfunctions of breathing or enhance its functions. Breathing, unlike most physiological functions, can be controlled voluntarily and it can serve as an entry point for physiological and psychological regulation [26].

You may be able to stop yourself from hyperventilating if you focus on taking controlled breaths. Controlled breathing may help you begin breathing normally once again [27].

The practice of controlled (conscious) breathing refers to inhalation, retention and exhalation that can be performed quickly or slowly. Conscious breathing functionally resets the autonomic nervous system, which synchronizes neural elements in the heart, lungs, limbic

system and cortex [28]. Encouraging slow exhalation helps, because it buys time and allows CO_2 to build up before the next inhalation [29].

Summary

Numerous yoga breathing exercises (called pranayama) naturally cause increased carbon dioxide (CO2) blood concentration. Thus, hypercapnia is a normal outcome of Pranayama.[30] Research shows that controlled breathing therapy seems to be an effective treatment for patients with hyperventilation complaints [31].

Yoga improves the efficiency and adaptive nature of habitual forms of cognition, emotion, and behavior across systems of mind–body functioning through neurocognitive physiological appraisal and neurophysiological autonomic changes [32].

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Author's Contribution

It is to inform you that Dr. Umesh Pal Singh is the sole author of this article.

Competing Financial Interests

It is to declare that there is no issue of any kind of conflict of interest.

Recommended Readings

Books

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- Tsarfis PG (1985) Nature and Health: Treatment and Rehabilitation by Natural Factors. Mir Publishers, Moscow.

Links

https://www.omicsonline.org/open-access/evidencebased-role-of-hypercapnia-and-exhalation-phase-in-vagus-nerve-stimulation-insights-into-hypercapnic-yoga-breathing-exercis-2157-7595-1000276-94918.html

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