



Research Article

Hyperventilation Syndrome: A Diagnosis Usually Unrecognized

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Abstract

Hyperventilation syndrome is a common disorder that is characterized by repeated episodes of excessive ventilation in response to anxiety or fear. Symptoms are manifold, ranging from sensations of breathlessness, dizziness, paresthesias, chest pains, generalized weakness, syncope and several others. Although sudden and extreme anxiety usually triggers discrete attacks, a pattern may be chronic, recurrent and subtle. The resultant physical sensations often dominate and obscure the underlying hyperventilation and cause the over breathing to be overlooked. Diagnosis and treatment rely on reproduction of symptoms by voluntary forced rapid breathing in the clinic, producing many of the recognizable symptoms and allowing for understanding and conscious breath control by the patient. Through this means the attacks may usually be ameliorated or eliminated entirely.

Keywords: Anxiety; Depression; Hyperventilation syndrome; Non-cardiac chest pain; Panic attacks; Psychosomatic disorders; Syncope

Introduction

Hyperventilation is one of the most commonly overlooked diagnoses in all of clinical medicine [1,2], occurring most often in young or middle aged subjects, and is estimated to constitute approximately 5%-10% of all general medical patients. Moreover, its manifestations may be chronically disabling, for in my personal experience in evaluating applicants for permanent disability status, I have estimated a frequency of as high as 15% or more. Despite its high prevalence, however, this diagnosis regularly eludes family practitioners, internists, and also several specialty groups as well, notably neurologists, cardiologists and psychiatrists. Although associated panic with extreme anxiety is usually obvious during the episodes, the somatic manifestations such as dizziness, weakness, chest pain, dry mouth, numbness and tingling often divert attention from the causative breathing disorder. Obscuring recognition even further, the syndrome can acquire a more subtle chronic and recurring pattern [1]. In most instances,

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patients describe a feeling of shortness of breath, but they may be totally unaware of such rapid respiration. Once this diagnosis is suspected, simple measures can confirm its presence and allow for control of all the disagreeable bodily sensations, and, at the same time, reduce the underlying anxiety itself.

Cause of hyperventilation and physical effects

For most people, hyperventilation is rare and only occurs as an occasional response to fear or stress. For others, this condition occurs regularly as a typical response to emotional excesses such as fear, anxiety, or anger. When hyperventilation is a frequent occurrence, it is known as hyperventilation syndrome.

How emotional stress induces such a respiratory response is unclear, but it is likely rooted in the evolutionary "flight or fight" reaction, wherein, in anticipation of imminent need for increased exertion combined with increased adrenergic drive, rapid respiration results. If such exertion is not required, however, this response becomes disproportionately great, setting in motion the undesirable chain of events noted in this report.

The excessive breathing produces hypocapnia, respiratory alkalosis and a complex sequence of physiologic changes responsible for most of the signs and symptoms; these changes may even produce bronchoconstriction that may actually result in audible wheezing, augmenting the sensation of dyspnea as well as simulating or intensifying preexisting asthma [3,4]. Thus since it can complicate asthma, the clinician should consider both asthma and hyperventilation when encountering features of both conditions.

Certain other physical and chemical disruptions can produce excessive breathing, and these include aspirin overdose, left ventricular failure, pulmonary emboli, pyrexia and others. Exclusion of these various physical conditions is usually rapidly accomplished by careful history and physical examination. Hence this discussion is limited to the most common syndrome that is emotionally rooted.

Symptoms and their cause

Because of rapid mouth breathing, the sensation of dryness of the mouth is a regular feature. The sensation of dizziness, or giddiness, sometimes resembles true vertigo, and may culminate in unconsciousness and resemble seizures, suggesting diseases that cause syncope or vestibular dysfunction. These symptoms probably result from one or two causes: 1) transient alkalosis [5], which increases the avidity of oxygen binding to hemoglobin such that oxygen becomes less readily available to tissues, including brain cells (the Bohr effect), or 2) hypocapnia causes increased cerebral vascular resistance and decreased cerebral blood flow [6]. Symptoms may also be aggravated by upright posture, suggesting orthostatic hypotension. The somatic sensations of numbness and tingling (paresthesias) also probably originate in the brain, and they are typically perioral in location, but more often they affect the arms, hands, legs, and feet, occasionally dominant or exclusively localized to one side of the body-usually the left [7], simulating a vascular neurologic disorder. Additional symptoms include hot sensations, sometimes with diaphoresis, and feelings of chilliness. These

sensations likely result from adrenergic stimulation combined with peripheral vasomotor changes. Musculoskeletal pains and spasms, sometimes noted primarily in the chest, may also occur in a variety of locations, such as the head and back. The chest pain is often variable in nature, lasting from minutes to hours, often sharp and migratory; but it may occasionally resemble a cardiac origin. Nausea and symptoms consistent with aerophagia and globus hystericus are also commonly associated with the anxiety and rapid breathing. Hyperventilation produces sinus tachycardia and other electrocardiographic changes [8-10], most commonly downward shifts of ST segments with flattening of the T waves in the left precordial leads together with an apparent prolongation of the QT interval, changes resembling those of hypokalemia. Isolated T wave inversions and marked ST depressions are less common. The ST shifts can closely simulate cardiac ischemic changes, but they are usually not induced-or are even lessened-by exercise.

The patient him/herself may overlook the original excessive breathing, having become preoccupied with the associated somatic symptoms, and frequently complain that they often cannot get a "deep enough breath," and they may sigh repeatedly while being interviewed, with predominately thoracic rather than abdominal respiration, often describing themselves as being anxious and depressed [11].

In many other instances of hyperventilation, bizarre unexplained somatic symptoms in virtually any area may dominate the picture and appear more severe than any demonstrable organic disease. Under these circumstances, the clinician must carefully seek associated signs that can allow for suspicion of the underlying hyperventilation [12].

Why is hyperventilation so often missed?

Because of tendency by clinicians to fixate on the multiple secondary bodily sensations, the underlying excessive breathing is often overlooked. Since this syndrome does not belong in a category of organic physical disorders, medical textbooks and school curricula seldom devote much attention to this diagnosis per se. While the underlying anxiety and panic are considered psychiatric conditions, the apparent physical manifestations are mistakenly attributed to the anxiety itself, and as a result, little or no attention is devoted to the inextricably associated hyperventilation.

It was not until 1980 that the specific concept of the panic disorder was designated as a psychological diagnosis [13]. According to the latest psychiatric handbook, DSM-5 [14], diagnostic criteria for a panic attack include a discrete period of intense fear or discomfort, in which four (or more) of the following symptoms develop abruptly and reach a peak within minutes: 1) palpitations, and/or accelerated heart rate, 2) sweating, 3) trembling or shaking, 4) sensations of shortness of breath or being smothered, 5) feeling of choking, 6) chest pain or discomfort, 7) nausea or abdominal distress, 8) feeling dizzy, unsteady, lightheaded, or faint, 9) chills or hot flashes, 10) de-realization (feelings of unreality) or depersonalization (being detached from oneself), 11) fear of losing control or going insane, 12) sense of impending death, 13) paresthesias (numbness or tingling sensations), 14) chills or hot flashes.

Even cursory examination of this above list reveals that many of these symptoms attributed to panic likely result purely from hyperventilation. I have observed many of them even in otherwise normal individuals directed to purposely hyperventilate, including accelerated heart rate, trembling, dizziness, paresthesias, and hot or cold sensations. Although not included in the panic criteria, I have also regularly

observed dryness of the mouth and generalized weakness and fatigue. When subjecting individuals with suspected panic attacks to voluntary forced breathing, I have encountered the common reproduction of other features of the entire syndrome that include sensations of shortness of breath and increased anxiety. Sometimes, but not always, chest pains typical of attacks can be reproduced.

Anxiety and fear that initiate the hyperventilation spells probably contribute primarily to symptoms such as fear of losing control, smothering sensations, and sweating. These spells often occur in the setting of agoraphobia. In recent years, few authors have considered the possibility that hyperventilation could have caused many-if not all-of the multiple somatic symptoms. Some [15], however, have recognized that panic attacks are inextricably associated with hyperventilation, in which the excessive breathing per se induces disagreeable somatic symptoms that produce further anxiety, resulting in a vicious cycle of more frequent and severe attacks.

Various Medical Diseases Simulated by Hyperventilation

Neurologic disorders

The frequent occurrence of light-headed sensations, sometimes followed by syncope, often combined with paresthesias and weakness that can be dominant on one side of the body, suggest the possibility of a neurologic disorder such as cerebral vascular thrombosis or transient ischemic attacks. Various forms of neurogenic seizures are also suggested.

Cardiovascular disorders

In as much as the hyperventilation syndrome is but one of many causes of chest pain, its importance as a causative factor in populations without cardiac disease is of special interest. For example, Beitman et al., [16] in a study of non-anginal chest pain, provided a typical description of coexisting hyperventilation/panic disorder without considering the possibility that hyperventilation could have been an underlying contributor, an association that had been commonly noted previously [17,18].

A number of researchers have also examined functional disability and persistence of symptoms in patients with chest pain and normal coronary arteries, and they have discovered that approximately 40% have panic disorder [19]. In following such patients for up to six years or more, at least 70% continue to have chest pain, which is often debilitating. Approximately half reported being unable to work due to their symptoms and their usual daily activities were limited by chest pain despite the supposedly reassuring finding of normal coronary angiograms. They usually continued to consult repeatedly with their physicians for the same complaints, frustrated that nobody seemed to understand the source of their plight. This is understandable, for in none of these instances was the possibility of hyperventilation sought to explain the mechanism of the chest pain, without which efforts to control this disorder would have been futile.

Finally, cardiac dysrhythmias also may be suspected as an explanation for syncopal episodes.

Asthma

As noted above, hyperventilation may simulate or intensify asthma. Of importance, asthmatic attacks bear a disproportionately high relationship with both panic attacks and hyperventilation [4].

Other apparently physical conditions

In many other instances of hyperventilation, bizarre unexplained somatic symptoms in virtually any part of the body may dominate the picture and appear more severe than any demonstrable organic disease. Under these circumstances, the clinician must carefully seek associated signs that can allow for suspicion of the underlying hyperventilation [12].

Diagnosis and Treatment of Hyperventilation

First, given any of the manifold symptoms and signs noted above, it is incumbent on the clinician to suspect that the problem may be caused by hyperventilation, even if the breathing disorder is denied by the patient. Suspicion is especially important when the diagnosis of panic attacks is considered.

Given a high index of suspicion, the presence of underlying hyperventilation is usually easily confirmed. This is accomplished by reproducing many or all the symptoms after the patient is instructed to breathe rapidly and deeply for at least two or three minutes, or at least until some discomfort such as paresthesias or dizziness is experienced, which can be identified by the patient as being identical to some or all of those experienced during an actual episode. Once recognized, prevention and control of at least this part of the disorder are usually successful through explanation of symptom causation and how the symptoms can be aborted by either breath holding or rebreathing into a paper bag. Before one recommends paper bag rebreathing, however, diagnosis of hyperventilation syndrome must be secure, for adverse events may occur if one overlooks serious underlying conditions of acute Myocardial Infarction (MI), pneumothorax, pulmonary embolism and others. By allowing patients to understand the origin of the overbreathing, the simple maneuvers described above not only relieve the symptoms but help to allay the underlying anxiety that initially triggered the attack. This can be reinforced even further by instructing patients to try purposely hyperventilating at home, bringing on the typical symptoms, and then realizing how quickly they can be reversed by breath holding.

Curiously, the associated chest pains may not be reproduced in such a short time frame, requiring a lengthier period of overbreathing to develop [20]. Alternatively, the chest pains may originate independently in the musculoskeletal system but intensified during an actual episode.

Although laboratory confirmation of this disorder with the use of respiratory testing for reduced blood and alveolar levels of CO₂ has been advocated [15], I consider this unduly complex and expensive, but such testing could be reserved for difficult cases. Similarly, treatment aimed at training of proper breathing techniques rather than this simple explanatory approach detailed above, could be reserved as a secondary measure.

Few systematic studies have sought to demonstrate a causative role for hyperventilation in producing and sustaining panic attacks. One study [21], however, did demonstrate such a close relationship, providing a basis for treatment of both the breathing disorder and the panic state. In this instance, patients were provided a CO₂ sensor and an audio playback device. The patients were directed to perform repeated breathing sessions per day for 28 days in their own homes. This treatment enabled patients to normalize their breathing patterns by controlling their respiratory rate and exhaled CO₂, as measured by the sensor. The results were striking, for after 12 months, 68% of patients were panic-attack free, 96% of patients had reported a

significant reduction in their panic symptoms, and all patients experienced long-lasting reductions in panic attack frequency and severity, anxiety symptoms, and avoidance behaviors, all of which were coupled with improvements in mood and quality of life. If confirmed by similar studies, this could provide a major step toward diagnosis and management of many-if not all-panic syndromes. This observation accords well with the likelihood that the panic and hyperventilation are often inextricably associated, providing a vicious cycle between the two, i.e., panic initiates hyperventilation, and symptoms from the latter then trigger more panic. As a practical matter, simple measures, as described above, may suffice to prevent and control the entire sequence of symptoms associated with panic in the vast majority of afflicted patients.

Treatment of the underlying anxiety can benefit this disorder through a pharmacologic approach with benzodiazepines, antidepressants and cognitive behavioral therapy. Interestingly, however, those recommending such treatments generally ignore the presence and potential benefit of the simplified breathing measures already presented [22].

Conclusion

Hyperventilation is one of the most commonly overlooked diagnoses in all of clinical medicine, baffling family practitioners, internists, and also several specialty groups as well, notably neurologists, cardiologists and psychiatrists. Although associated panic with extreme anxiety is usually obvious during the episodes, apparent somatic manifestations such as dizziness, weakness, chest pain, dry mouth, numbness and tingling often divert attention from the underlying breathing disorder. Patients often describe a feeling of shortness of breath, but may be totally unaware of such rapid respiration. Once suspected, simple measures of diagnosis and treatment usually suffice to prevent and control the disagreeable bodily sensations as well as the underlying anxiety itself. Such measures, if employed early in evaluation, can allow for the avoidance of costly and complex additional tests such as brain imaging, stress testing, interventional cardiovascular procedures and many others.

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