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The Hidden Disorder: The Psychophysiology Of Hyperventilation

Rapid heart, cold sweat, dry mouth; dizziness, flatulence, depersonalization; rigidity of limbs, shortness of breath, exhaustion of spirit. Because this chameleon of disorders mimics a variety of others, and because almost none of its symptoms are specific to it, diagnosis is tricky. Besides, few clinicians think to look for it.

People who suffer from the myriad of symptoms triggered by hyperventilation -- breathing more air in and out than the body requires (see sidebar) -- are frequently dismissed as hypochondriacs. Unaware that their patents are suffering from a breathing disorder, doctors and psychotherapists advise them to relax and "take a few nice, deep breaths." But for people who hyperventilate, taking a "nice deep breath" is a major problem.

Hyperventilation syndrome is estimated to affect up to 25 percent of all patients who visit cardiologists, psychotherapists, allergists, gastroenterologists, and other medical specialists, looking for relief. Sometimes hyperventilation coexists with other physiological or psychological disorders. Although it's true that it is frequently a result of one of these disorders, hyperventilation may just as often be a cause. Research continues to build up evidence of the often subtle yet direct cause-and-effect interactions between hyperventilation and disorders such as asthma, panic, and chronic fatigue syndrome.

About 20 years ago, clinical researchers at London's St. Bartholomew's Hospital were having difficulty measuring and monitoring breathing patterns in their hyperventilating patients. During the course of a workshop they convened with sleep researchers, anesthetists, and others experienced in breathing measurement,

the St. Bartholomew's scientists realized how many interests other than tallying up end tidal volumes and air exchange rates they had in common with their guests. The following year, in 1982, a second workshop examined breathing's role in a multitude of disorders that by now most participants suspected were neither purely psychological nor purely physiological. Thus was the field of respiratory psychophysiology born.

One of the field's pioneers, the British chest physician L.C. Lum, realized that clinicians did not often consider factors that might lead them to a diagnosis of hyperventilation. This disorder, he was well aware, could have its origins in the mind as well as the body, and could produce symptoms that were experienced as both mental and physical. He cited this example: during the week before menstruation, women have elevated levels of the hormone progesterone, which stimulates hyperventilation. By reducing blood carbon dioxide levels, hyperventilation results in a mild alkalosis, which produces headaches, tiredness, and irritability -- the classic symptoms of premenstrual tension. Doctors who consider the connection between progesterone and alkalosis might instruct women how to modify their breathing during the week before menstruation, Lum said.

Breathing is the one vital function over which humans can have some conscious control. Most of the time, however, breathing is regulated by our autonomic nervous system (ANS), which also regulates such "automatic" body functions as digestion, urination, gland secretion, and heartbeat. Research results accumulating for the past twenty years have demonstrated the role of the ANS in stress-related disorders. These results have also supported the centuries-old observations made by practitioners of yoga and meditation that many of our body functions can be brought under the control of our conscious mind.

The sympathetic nervous system (SNS) is the part of the ANS that is responsible for the "fight or flight" response to real or perceived threat, or to another form of stress. The SNS shunts blood and oxygen away from such

momentarily nonessential functions as digestion, and towards emergency preparedness. The result is increased blood flow to the muscles, faster heartbeat, and other signs of mobilization -- including hyperventilation. Mobilization also results in psychological changes that produce subjective states that sometimes are interpreted as fear or panic. Although hyperventilation is a normal response to stress, it becomes abnormal when it becomes an habitual accompaniment to the garden-variety stress of everyday living. Chronic hyperventilaters frequently respond inappropriately to this kind of normal stress.

Breathing retraining programs have demonstrated much success in treating hyperventilation and hyperventilation-related disorders. The goal of the programs is to show people how to bring their over-breathing under conscious control. In fact, voluntarily altering breathing to treat illness or to improve the functioning of body systems has long been a practice within segments of some Eastern cultures. The yogic techniques of prolonging the breathing-out over the breathing-in phase and of adding resistance to both phases, for example, are similar to the techniques of modern breathing retraining programs. Using techniques such as muscle relaxation, biofeedback, and imaging, these programs have helped people suffering from a variety of psychophysiological disorders learn how to breathe normally.

Ronald Ley, experimental psychologist and professor at State University of New York, Albany, says that Western doctors and psychotherapists are often resistant to the idea that changes in breathing patterns can be a cause and not just an effect of changes in both physiological and psychological states. Essentially, Ley says, that's because Western thought considers mind and body as two separate entities, with the functions of both entities being separate as well. However, that we can exert some control over our breathing demonstrates the bridge that exists between the two, Ley says:"If at least some psychiatric disorders are a manifestation of faulty cognition or thinking, and if thinking is a product of brain activity, and if brain activity depends on adequate oxygen and carbon dioxide, well, there's the bridge."

Ley's earliest inquiries into why many, but not all, panic attack patients are fearful during their attacks prompted him initially to offer a hypothesis based on patients' cognitive misattributions: fearful patients assume that their hearts and breathing rates speed up because they are about to suffer something serious such as a heart attack or a stroke. Ley's later work and the work of others, however, prompted him to consider that this hypothesis wasn't sufficient to explain the origins of fear in panic patients.

Those studies showed that panic patients frequently do not attribute a cause to their fear until *after* the attack is over, indicating that the source of the fear must lie within the cardiac and respiratory symptoms themselves. Says Ley: "The fear that occurs during a hyperventilatory panic attack seems to be a direct response to the disordered breathing itself, particularly if the person thinks she can't control her breathing. This dyspnea or labored breathing, then, is the most likely stimulus for the fear." Ley points out that just as a person whose head is being forcibly held underwater becomes terrified, so will people suffering from panic attacks -- unless they become aware that they are not going to suffocate, even though it feels like that is what is happening to them.

Ley says the proof that numerous psychiatric symptoms are a consequence of disordered breathing is demonstrated by the ease with which research procedures can elicit these symptoms in normal people, and then eliminate the symptoms. He acknowledges that experimental and real-life experiences are not necessarily equal: after all, hyperventilating in a nice, safe research lab is different from hyperventilating while driving a car down a congested major highway with big, booming trucks weaving in and out everywhere.Still, Ley says, respiratory psychophysiologists are increasingly successful at helping people with hyperventilation-related disorders learn how to retrain their breathing.

Even when hyperventilation appears minimal in a patient who has what seem

to be purely psychological problems, it may be what keeps a unhealthy psychological structure going, says Herbert Fensterheim, Department of Psychiatry, Cornell University Medical College. One of Fensterheim's panic patients was a chronic hyperventilater, a man who was also a compulsive gambler and who previously had been diagnosed with "fear of success syndrome". Fensterheim determined that the man's panics were triggered by his hyperventilating from the stress of excitement he felt whenever he'd come close to a big win at the gaming table. When the man started to lose, however, he'd become depressed, and the depression calmed his panicky feeling by producing a breathing slow-down. Rather than rely on his patient's ability to cure one psychiatric disorder by substituting another, Fensterheim encouraged him to undergo breathing retraining, which did away with the neurotic coping pattern.

A person who has anxieties about anything at all might easily go into hyperventilation mode. Say she's anxious before giving a toast at a business luncheon: if she begins to hyperventilate, her anxiety level goes up higher. So she concludes that to avoid feeling anxious, she ought to forego speaking at future social or professional gatherings, and eventually she avoids talking in front of more than two or three people. Fensterheim suggests that for some people, hyperventilation might form the core of a entire neurotic avoidance structure, and that psychotherapists should consider screening their anxious, avoidant patients for it.

Therapies to counter anxiety or stress often involve teaching patients focused breathing techniques for deep relaxation, as Fensterheim did with his chronic hyperventilater. But hyperventilation can make mastery of these breath-based techniques next to impossible -- in addition to helping create anxiety in the first place.

For anxious patients with phobic fears of objects or situations, learning to breathe normally in the face of their phobic trigger is typically a necessary first step

in treatment, says Fensterheim. Unfortunately, when they think about having to encounter their triggers, phobic patients often begin to hyperventilate -- which of course worsens their anxiety. But is is relaxed, repeated, and successful encounters with these triggers under the guidance of a therapist that is precisely what phobics need to desensitize themselves to their fears.

Patients being treated for anxiety say that, in addition to hyperventilating, they usually feel their hearts racing in tense, fear-provoking situations. The physiological mechanics of breathing and heart rate are interconnected: breathing centers in the brain also help regulate the heart rate, slowing it down during exhalations and speeding it up during inhalations. In normal breathers, variability in heart rate between breathing out and breathing in is pronounced. But in chronic hyperventilaters and anxiety patients, the variability curve is quite flat. Such flatness is associated with a number of cardiovascular symptoms.

Approximately one in ten patients who complain of chest pain, "surging," breathlessness, and other symptoms that sound cardiovascular in origin show no evidence of heart disease. Over the years, doctors have given such names as soldier's heart, neurasthenia, and DaCosta's syndrome to disorders characterized by these and by other cardiovascular, psychiatric or respiratory symptoms. But whatever these disorders were called, most have been shown to be variations on the state of anxiety.

Patients who suffer from what is now known as functional cardiac syndrome often say they feel anxious just before they became aware of their cardiac symptoms. Because cardiologists can find nothing wrong with these patients, they sometimes refer the patients to psychiatrists. This is a good idea, say British respiratory psychophysiologists Christopher Bass, William Gardner, and Graham Jackson, because treating the syndrome successfully requires a body/mind approach. For example, they say that not only should functional cardiac patients be taught how to breathe normally under stress, the patients also should be encouraged to re-think thoughts and beliefs that might be triggering their anxieties.

But Bass, Gardner, and Jackson warn doctors against assuming that functional cardiac patients suffer *only* from symptoms of psychiatric origin, which they say cardiologists too often do. A number of studies have shown that the chest pain these patients experience often results from tightly constricted diaphragm muscles, which also produces the shallow, exaggerated chest breathing that is characteristic of hyperventilation.

Psychologist Richard Gevirtz and his colleagues at California School of Professional Psychology will soon publish preliminary results of a study of breathing retraining with functional cardiac patients. The 40 participants reported suffering from cardiac symptoms an average of 11 days out of a typical two-week period before the breathing retraining began. During the two weeks immediately following the retraining period, participants reported an average of only five days of symptoms. On follow-up three years later, the 20 participants contacted reported an average of just a half a day of cardiac symptoms over a typical two-week period.

Says Gevirtz: "Our patients internalized the research protocol, meaning they learned to feel when they were hyperventilating, and to modulate their breathing accordingly. Although we used biofeedback equipment during the study, the patients didn't need it afterwards. They became their own source of biofeedback." Gevirtz says that breathing retraining, although “better than chicken soup” for many anxiety and functional cardiac patients, should be undertaken concurrently with cognitive psychotherapy.

Gevirtz is also looking at how breathing rate and depth plus other physiological and psychological variables influence panic disorder, and is attempting to cluster variables according to the degree to which they contribute to the disorder. For instance, some panic patients misinterpret normal events, assigning ominous import to them for their own reasons. The psychological variables under consideration here, he says, are the patients' beliefs and perceptions that help to

explain their reasoning. But Gevirtz adds that psychophysiological profiles show that panic patients tend to differ from normals *primarily* on breathing and not on other physiological or psychological variables, which he says supports the idea that disordered breathing plays a major role in panic.

"Recently, we started looking at people who hyperventilate just a little bit, but all of the time. They'll be sitting, watching `The Price Is Right', nothing going on, really, and then, *bam*! they'll have a panic attack." What seems to be happening with these people, Gevirtz says, is that their low-grade yet chronic hyperventilation ultimately raises their blood alkalinity levels too high (alkalosis,) which triggers their panics. He adds that he thinks many alcoholics are self-medicating panic sufferers who drink primarily to stave off their attacks.

People who also suffer from obstructive breathing disorders -- asthma, bronchitis, and emphysema -- use about one-third of their energy just to breathe, while normal breathers use about two to three percent.. Anything that causes the nasal passages or trachea to constrict, or causes the lungs to become less elastic, increases resistance and makes the work of breathing harder: obstructive breathing disorders do both. Hyperventilation triggers a reduction in carbon dioxide pressure within the arteries, adding to the constriction and resistance within the respiratory system, so hyperventilaters who also have an obstructive breathing disorder such as asthma have an added burden in breathing energy expenditure.

No physiological cause has yet been pinpointed for asthma, but its relationship with hyperventilation is well-established. Asthmatics usually take shallow "chest" breaths, with upper ribs held high and diaphragms constricted, even when they're not having an attack. They tend to inhale for about twice as long as they exhale. Although breathing retraining treatment has concentrated on reducing breathlessness and boosting arterial carbon dioxide pressure, teaching asthmatics how to relax contracted breathing muscles and the deeper, supporting muscles can be as big a benefit, says Imke Buchholz.

Buchholz is a breathing therapist who bases her work on the techniques developed by Elsa Gindler, the "mother of German breathing therapy." Gindler sought to augment the role breath as a force of healing by teaching people how to release tension stored in their breathing and supportive skeletal muscles. Because active hyperventilaters so often mold their muscles into the classic "fight" posture -- hunched-up shoulders, thrust-out head and neck, and clenched jaw -- they often get aches and spasms in these muscles. In time, the result is continual muscle tension, which Buchholz says breathing retraining can help relieve.

Buchholz points out that many of us are busy training our outer muscles, but we neglect the deeper, supportive layers, which among other benefits help our breathing muscles to move freely. She says that breathing retraining to strengthen these deeper muscles also reduces bronchial swelling and clears excess mucous from the lungs, thus decreasing airway resistance and making it easier to breathe. Such retraining also helps "stabilize the person's psychological situation, too," she says.

Hyperventilation also can affect disorders that are not primarily respiratory in nature. Today, more and more clinicians are diagnosing patients with chronic fatigue syndrome, which they usually attribute to an ongoing viral infection. But Peter Nixon, a British lung physician and researcher, says that the diagnosis keeps contributory, treatable conditions like hyperventilation "subsumed and lost to sight." Studies of chronic fatigue patients have shown that almost all of them had been regular hyperventilaters for an average of two years before some physical or emotional stress triggered their fatigue. Hyperventilation over a long period of time disturbs the body's acidic/alkaline balance, Nixon says, and anything that interferes with our self-regulatory balancing mechanisms compromises our normal good health.

What limits, exactly, do breathing problems place on this "normal good health?" Do ideal breathing patterns exist for active and resting states? Do they vary from person to person? What breathing variables are associated with different

emotional states? Answers to these and other questions require much more basic research, say respiratory psychophysiologists. Studies are especially needed to weigh the relative importance of both the physiological variables that control automatic breathing and the psychological variables that undergird breathing's conscious control. Without these studies, say people in the field, advances in treating hyperventilation and the myriad of disorders with which it is associated will lag. And we will have to wait longer for the day when clinicians routinely view hyperventilation as not only a consequence of underlying disorders, but as a possible cause. For people who suffer from these disorders, let us hope that the wait will not be too long.

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SIDEBAR

To understand hyperventilation, let's consider normal breathing first. We inhale oxygen to fuel our metabolism, which is the sum of all the body's energy-creating processes, and exhale carbon dioxide, which is metabolism's byproduct. The demands of metabolism govern both our rate of breathing and the volume of air that gets exchanged. During exercise or when we're under stress we breathe more rapidly and deeply because our metabolisms require extra oxygen to make extra energy. We also push out the additional carbon dioxide our revved-up metabolisms produce. This, however, is *not* hyperventilation -- this is breathing appropriately in response to increased metabolic demand.

Hyperventilation is shallow, rapid breathing usually triggered by anxiety or fear that isn't related to the physiological energy demands being made on our bodies by our usual activities. Although it might look like someone who's hyperventilating is sucking in mass quantities of air, hyperventilation actually reduces by about half the vital oxygen available to the brain, and gets rid of too much vital carbon dioxide. Far from being a mere metabolic waste product, carbon dioxide must be maintained at appropriate levels to keep our blood at its normal alkalinity/acidity balance. Too little Co2 for too long equals too much alkalinity equals alkalosis. Not fun.

So if you find yourself hyperventilating out of anxiety (or a misplaced desire to experiment,) and if you then begin to feel dizzy or light-headed, or your hands or feet start to go numb, or your heart begins to beat erratically, calm yourself as best you can by breathing slowly in and out while counting for a few minutes. If you can't restore regular breathing rhythms after this time or you lose your ability to concentrate, you should get some medical attention.

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