THE HAZARDS OF HEAVY BREATHING

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YOU HAVE to breathe to live. But if you breathe too much you may end up in a psychiatric clinic suffering from panic attacks or agoraphobia, or being rushed to hospital with a suspected heart attack. You may even find yourself referred to some other medical specialist-a gastroenterologist or possibly an allergist.

Most doctors recognise the effects of acute hyperventilation or "overbreathing" - a hysterical fit often accompanied by muscle spasm or even coma. But chronic hyperventilation at low levels can produce a wide range of physical and mental symptoms that may be either misdiagnosed as something serious or dismissed as hypochondria.

Hyperventilation is a normal response to stress. It is the basis of the primitive "fight and flight" mechanism. Rapid shallow breathing cannot increase the amount of oxygen in the blood because red blood cells normally leave the lungs with their haemoglobin almost entirely saturated with oxygen. But it can increase the amount of carbon dioxide that is blown out, disturbing the body's acid balance and producing various physiological changes.

These changes lead to the altitude sickness experienced by mountaineers and, in the past, pilots. Here, it is not so much lack of oxygen that leads to difficulties but low levels of carbon dioxide caused by overbreathing to compensate for the "thin" air at high altitudes.

After several days, however, most people acclimatise to the new environment, as their bodies establish a new equilibrium. Mountain dwellers have lower levels of carbon dioxide in their blood than people living at sea level, but they do not become ill. This suggests that it is changes in the level of carbon dioxide, rather than the absolute level, that is the problem.

People have exploited controlled hyperventilation for centuries to achieve certain physical and mental states. Some religious sects use it combined with yoga to produce the "spaced out" feeling experienced in transcendental meditation. The Pocomaniacs, a fundamentalist Christian sect in Jamaica, use it in religious ceremonies to bring about a similar mental state in which they can "see the Lord". Many of them have an orgasm at the same time hardly surprising as an orgasm is impossible without a degree of "panting" to destabilise the autonomic nervous system.

Participants in war dances hyperventilate to generate feelings of invulnerability. Physically it can cause numbness of the limbs, producing an anaesthetic effect and altering the pain threshold. Dervish rituals are designed to achieve this effect so that self-wounding becomes possible.

But uncontrolled hyperventilation is a different matter; it can be crippling and sometimes life-threatening. It can affect the cardiovascular system causing palpitations, missing heart beats, chest pain and Raynaud's disease, a deadening of the fingers and toes. It can destabilise the central nervous system to cause dizziness, disturbances of vision, and tingling sensations or numbness.

Effects on the gut include wind, pain, diarrhoea and constipation. It can cause muscle pains, tremors and spasms of the limbs, as well as fatigue, exhaustion, general weakness and sleep disturbances. These symptoms are frequently accompanied by tension and anxiety, which in some people may lead to panic attacks or agoraphobia.

Claud Lum, a chest physician at Papworth Hospital in Cambridge who was one of the first doctors to recognise this syndrome, says it has replaced syphilis as "the great mimic". He estimates that up to 10 per cent of all patients referred to specialist clinics are suffering primarily from hyperventilation.

Twelve regular breaths a minute, each containing around 600 cubic centimetres of air, are all you need to supply your blood oxygen. Anything more, especially if your breathing is shallow and erratic, and you could be in trouble. But apart from the distressed panting seen in cases of acute hyperventilation, it is not easy to spot. The breathing rate can increase to 20 breaths per minute, and the volume of each breath to 900 cubic centimetres, and breathing will still appear normal, although the intake of air will have doubled.

There are a few give-away signs. Hyperventilators use only their chest when they breathe, whereas normal breathing is mainly abdominal, and their breathing is often interspersed with sighs or yawns. Many people can be treated by being taught how to breathe properly once they understand that their problems are caused by bad breathing habits. Doctors ask them to over breathe at a rate of 30 to 40 breaths a minute for three minutes to reproduce their symptoms. Using such methods, Lum claims to have completely cured 80 per cent and helped another 10 per cent of the 3000 patients he has treated for hyperventilation over the past 20 years.

Breathing retraining can certainly help some patients suffering from agoraphobia, as well as other phobias and panic attacks. A team of clinicians at St Bartholomew's Hospital in London found that patients receiving breathing retraining followed by repeated exposure to the feared situation did much better than those just treated by repeated exposure. Six months later, those taught to breath in the >correct" way were still improving, while the others have begun to relapse.

But Beverly Timmons, a research psychologist in the department of medical electronics at St Bartholomew's Hospital, says it is not clear whether the psychological or breathing training should come first; people who are anxious or depressed find it difficult to learn.

Researchers at the Warneford Hospital in Oxford and King's College Hospital in London are looking at the role of hyperventilation in panic attacks: David Clark at the Warneford believes that, in some patients, fear of the physical symptoms caused by hyperventilation may be at the root of panic attacks. Palpitations, for instance, may be interpreted as the be inning of a heart attack, or tingling sensations as symptomatic of a brain tumour.

"It is how they perceive the symptoms," he says. In one study, researchers asked two groups of students to over breathe. One group, told that tingling and faintness indicated heightened consciousness, said it was a pleasant experience. But students in the other group, told it could lead to collapse, became more anxious.

Christopher Bass, a psychologist at King's College Hospital, believes that trying to reproduce symptoms by overbreathing for three minutes is not a satisfactory way to diagnose hyperventilation. Clinicians should also take exercise and emotional stress into account and measure levels of carbon dioxide continuously through the skin for 24 hours.

Such a complicated and time-consuming regime may not be practical for most clinicians, but there is growing support for the idea that emotional stress may be important. Peter Nixon, a cardiologist at Charing Cross Hospital in London, believes that hyperventilation not only produces symptoms that mimic heart disease but may trigger a heart attack in some situations.

Because of this, he believes cardiologists should test their patients for hyperventilation. The standard three-minute overbreathing test is unacceptable, he argues, because it does not take account of emotional stress. "When a patient is sitting calmly with a doctor, relaxed and comfortable, hyperventilation may not do much. Only when a person is strained or exhausted and the body chemistry is trigger-happy will it have an effect," he says.

So in taking medical histories he notes any points which seem to cause distress. Then, after doing all the usual cardiac tests, he asks about these incidents, and finds that this frequently leads to hyperventilation. Sometimes he uses hypnotism to help patients to recall important events.

Nixon says that 80 per cent of people with angina are suffering mainly from hyperventilation. No more than 15 per cent have a narrowing of the coronary arteries serious enough to require surgery or medication, and another 15 per cent have completely normal arteries. The rest have some narrowing, which is dangerous only if they become badly stressed or exhausted and begin to hyperventilate.

The physiological changes produced by this include constriction of the blood vessels the production of large amounts of adrenaline and increased activity of the sympathetic nervous system. It also increased the ability of the blood to clot and destabilises the rhythm of the heart. "This is a recipe for sudden death in some circumstances," he says.

Heart surgery is useless, according to Nixon, unless patients recognise the effect that stress is having and learn to control their hyperventilation. In some cases, surgery can be avoided altogether and remission induced just by removing these dynamic factors. "A heart attack," he says, "needs hyperventilation and primed body chemistry."

Everyone hyperventilates in response to acute stress, but some people continue to do so even after the cause of stress is removed, and often the symptoms brought about by overbreathing then become a new source of stress, beginning a vicious cycle. Lum says hyperventilation is more common in young women and in middle-aged men. A particular personality type seems more prone to this disorder-the ambitious perfectionists who stress themselves to cater to this. "People who suffer from hyperventilation are tough," he insists. "They are not no-hopers but are successful achievers who have mistaken the load they can carry."

Hyperventilation can be a habit learnt in childhood as a result of psychological stress or physical illness. Or it may be a more recently acquired habit-the aftermath of two or three years of marital or financial pressures. For some people, it may be an occupational hazard. Singers, actors and public speakers are especially at risk. "Stage fright" is often a panic attack which may cause or be caused by hyperventilation. Most theatres in London's West End recognise the phenomenon and keep paper bags handy so that those who need to can breathe into them-this puts carbon dioxide back into the blood. Then there is the "designer jeans syndrome". Jeans that are too tight can restrict abdominal breathing so that shallow, rapid thoracic breathing becomes a habit.

On the other hand, there may be some underlying organic cause, in particular, a respiratory disorder. Asthmatics, for instance, cannot breathe deeply and to compensate will try to breathe faster. The result is that they may blow out half of the carbon dioxide they inhale instead of one-fifth. In many, this is a permanent state and a sort of acclimatisation takes place, with the body getting used to the lower level of carbon dioxide. But if they are then cured of their asthma, so that deep breathing becomes possible again, the faster breathing rate begins to cause serious problems as increased hyperventilation makes the carbon dioxide levels fall even further.

Lawford Hill, a chest physician at Warwick Hospital, is convinced that there is an underlying physical cause in most cases of chronic hyperventilation. He has identified a condition known as bronchiectasis in many patients who are apparently suffering from hyperventilation and nothing else.

In bronchiectasis, the walls of the bronchi (the air passages in the lungs) are corrugated and voluminous so that the airflow becomes turbulent and is impeded. Patients are aware that they cannot get a satisfactory breath and so they breathe more rapidly to try to compensate. But this condition does

not show up in measurements of gas transfer or chest X-rays. Bronchiectasis may have different causes but most often it is the result of repeated virus infections in childhood or scarring from whooping cough or measles.

Hyperventilation is also much more common among patients with allergies, although it is not yet clear which is the cause and which the effect. It is known that low levels of carbon dioxide in the blood will alter the activity of mast cells, causing them to release histamine which can in turn produce various allergic symptoms. On the other hand, McEwen has found that many people with food allergies will hyperventilate after eating something to which they are sensitive. One of his patients is an opera singer who loses her voice on stage as a result of a bout of hyperventilation every time she eats wheat.

Much surrounding hyperventilation remains mysterious, and a matter of contention. A recent seminar on the subject at the Hospital for Nervous Diseases in London reflects the state of the art, aptly named: "Hyperventilation: current controversies of definition and diagnosis."

THE LOW level of carbon dioxide in hyperventilation triggers a wide range of physiological changes, many of which are not fully understood. It affects the activity of many cells within the body, especially those in the nervous system.

Even a slight fall in overall levels of carbon dioxide will stimulate nerve cells, which then prime the body for action. Muscle tension is increased, sensitivity and perception heightened, the pain threshold lowered and adrenaline released into the blood-the "fight or flight" mechanism is in action

But as carbon dioxide levels fall even further, cells begin to produce lactic acid to reduce alkalinity, and metabolism begins to suffer. Fatigue, exhaustion and coma may result. The initial stimulation of nerve cells brought about by hyperventilation can cause tingling sensations, numbness, anaesthesia and, in some instances, convulsions.

The cells making smooth muscle are also kicked into action by low levels of carbon dioxide. The effect is to constrict blood vessels, including those serving the heart and brain. The heart may begin to pound, miss a few beats, produce palpitations or angina pains. The brain may receive up to 50% less oxygen because the kidneys have to ensure the than normal, leading to dizziness, faintness, flashing lights, tunnel vision as well as a feeling of unreality.

Low levels of carbon dioxide can also cause chemical changes in the membranes of mast cells, a type of white blood cell that plays a part in the immune system. This stimulates the cells to release histamine and other chemicals, which may reinforce changes already under way, such as the constriction of the blood vessels.

Carbon dioxide also helps to maintain the correct pH -7.4- within the body. But if the level of carbon dioxide falls in the blood and other body fluids, molecules of carbon dioxide diffuse out of cells to replace it. The cells then become more alkaline than normal, and may be spurred into frantic activity.

One of the ways the body tries to correct excess alkalinity is to excrete negatively charged bicarbonate ions in the urine. These are taken from the weak carbonic acid in the blood, and their removal leaves positively charged hydrogen ions in the blood, making it more acid.

But this can cause other problems, because the kidneys have to ensure the ionic balance of the urine they excrete. They do this by excreting positively charged metal ions along with the bicarbonate. According to Len McEwen, these are mainly magnesium ions from inside cells, where two-thirds of the body's magnesium is held. Cells, however, need to maintain their proper ionic balance too, and if they are short on magnesium they may pull in or manufacture positive hydrogen ions instead.

This is where the problem arises, because cells judge acidity by the presence or absence of hydrogen. If there is excessive hydrogen inside the membrane they will see this as excess acidity, even though the outside is too alkaline. These cells will therefore push the body to hyperventilate even more to raise alkalinity.

In this way, low levels of magnesium combined with hyperventilation may create a feedback loop that perpetuates the situation indefinitely. McEwan reports that he has found low levels of magnesium within cells in all his patients who hyperventilate, and claims that he can cure some by just giving them magnesium supplements.