On Being Able to Sleep and Breathe at the Same Time

by Robert Sack, M.D.

The human airway, the "wind pipe," is not like a lead pipe. At the back of the throat, the walls are soft and flexible and have to be braced open by muscles. During sleep, these muscles relax and the airway normally narrows a bit. If the opening gets small enough, the air stream becomes turbulent, the surrounding soft tissues of the throat vibrate, and the sleeper begins to snore. Although it may be just funny or embarrassing, snoring is the first stage of a potentially serious airway obstruction.

If the opening gets so small that only about half of the air gets through, it is called an hypopnea (derived from the Greek *hypo* meaning *less* and *pnea* meaning *breath* or *air* – the same root for *pneu*monia or *pneu*matic). After about 15 to 20 seconds of reduced air movement, the oxygen concentration in the bloodstream declines, triggering a message to the brain which says "It's getting a bit stuffy down here." The brain responds, "Breathe harder!" So the chest muscles redouble their work, trying to suck more air into the lungs and the snoring may get even louder.

But it's like sucking a milkshake with a soggy paper straw – the harder you suck, the more likely you will produce a complete collapse of the airway resulting in an "apnea." (*a* meaning *no* and *pnea* meaning *breath*; i.e., no breath, no air). Because no air is moving, the loud snoring is replaced by an eerie silence that can last up to a minute or more.

It goes without saying that an obstructed airway is incompatible with a long life. Thankfully, there are guardian-angel reflexes that (almost always) come to the rescue, saving the patient with apnea from a sudden death. An emergency message goes to the brain: "Hey man, you are suffocating – wake up!" A snorting sound erupts from the sleeper as he (its more often a male) stirs to catch his breath. It's not a full awakening, but just enough to restore muscle tone in the throat and get the airway braced open again. It's as if the person with obstructive sleep apnea has to wake up to breathe; in other words, he can't sleep and breathe at the same time.

After unknowingly surviving a "near-miss," the person with apnea falls back to sleep, but not for long: as he descends into a deeper sleep, his airway narrows again until another apnea/ arousal jerks him away from the preci-pice of suffocation. It is not unusual to have 40 or 50 apneas an hour – sometimes hundreds in a night.

Muscle relaxation is greatest during REM (rapid eye movement) sleep. In fact, there is near-paralysis, presumably so people won't act out their dreams. Consequently, obstructive sleep apnea is more likely to occur when you are dreaming. (Did you ever have a frightening dream in which you tried to scream, but couldn't? It's because you are nearly paralyzed.)

No wonder our hapless apnea sufferer awakens feeling like he hasn't gotten much sleep. During the daytime, when life becomes a bit quiet or boring, his eyes get heavy and he may doze off (let's hope it's not when he is driving.) He may feel tired and grouchy. With time, his blood pressure begins to rise and if he doesn't get treated, he may even develop heart failure.

I have often wondered why the human species has evolved an airway that likes to play "chicken" with potential suffocation. Sleep medicine researchers have found it difficult to identify any non-human mammal that suffers from sleep apnea. About the only exception is the poor pug-nosed English Bulldog that has been bred to look somewhat like Winston Churchill in his later years (or was it Churchill trying to look like an English Bulldog?).

It seems quite likely that the tendency for sleep apnea is the result of one of those evolutionary tradeoffs in which the anatomy necessary for the development of speech resulted in a remodeled airway that is much more vulnerable to obstruction. The human throat is an amazingly complex structure, balanced for breathing, swallowing, talking and sometimes singing. Compared to our closest relatives the apes, the human larynx has descended to a much lower position in the throat, a requisite for producing the complex sounds necessary for intelligible speech. Apes can be taught some sign language, but they are anatomically incapable of mimicking human sounds, no matter how many banana rewards you give them.

Also, the customary human sleeping posture puts us at risk for airway obstruction. When we lay flat on our back, gravity draws the tongue down into the throat. If the lower jaw is just a few millimeters too short, it cannot hold the tongue far enough forward to prevent an obstruction. Contrast the human sleeping posture with a dog that sleeps with his head stretched out on the floor.

These anatomical risk factors have been amplified by the spectacular success of our species in insuring a readily available food supply (at least in the developed world) which has produced an epidemic of obesity. As people gain weight, the already marginal human airway is compressed by the addition of fat deposits in the neck. Charles Dickens was the first to write about the relationship between obesity, snoring, and sleepiness in his character Joe, the fat boy, described in the Pickwick Papers. At one time, this constellation of symptoms now termed sleep apnea was called the "Pickwickian Syndrome."

So what to do? One can remodel the throat even more. Historically, the first treatment to be used (and still used for most severe cases) was to perform a tracheostomy (make an opening in the neck below the level of obstruction). Although very effective, it is not an attractive option for most people. There are some other surgical procedures, but they are effective only about 50% of the time.

Colin Sullivan, an Australian, discovered a better way. He made an air-tight mask that fit over the nose and attached it to a tube connected to his wife's vacuum cleaner which was set to run in reverse so that it blew air into the airway, bracing it open through the night. Eureka! (No pun intended.) It worked! The refined version of this invention, called a CPAP (continuous positive airway pressure) machine is now a common fixture in millions of bedrooms. Some surveys suggest that one in every 10 or 12 adults should have one.

The most immediate reason to treat sleep apnea is to improve a person's quality of life. Although they may be in bed for eight hours a night, a person with apnea may get the equivalent of three or four hours of sleep (imagine living on that amount of sleep and you will know what it feels like to have sleep apnea). Apnea starts so gradually that the person may have forgotten what it's like to be fully alert. Getting a normal sleep at night (using CPAP) results in normal alertness during the day. And don't forget the suffering of the bed partner who has to sleep next to a roar that can approach (according to some actual measurements) the intensity of a 747.

But there may be even more serious consequences for untreated patients with severe apnea, including tragic accidents related to sleepiness, as well as heart problems and high blood pressure.

I love to hear my patients recite their Rip Van Winkle stories – "feeling awake after all these years." The patient's happiness is rivaled only by the spouse's who can now sleep with the just-audible hiss of the CPAP equipment in the background. What a difference a little puff of air in the nose can make.