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Sleep GRD



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Sleep Issues in Gastroesophageal Reflux Disease: Beyond Simple Heartburn Control

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Learning Objectives

Upon successfully completing this continuing education course, you should be able to:

- Define Gastroesophageal Reflux Disease, discussing its major features
- Describe the connection between GRD and sleep disorders
- Identify possible treatments for GRD, with an eye to reducing sleep disruption

Introduction

In the recent past, sleep's implications for the physiology and pathogenesis of disease have been ignored. With the evolution of sleep laboratories, an awareness of the relationship between sleep and various gastrointestinal phenomena has been rapidly emerging. Most notable has been burgeoning interest in the relationship between sleep-related gastroesophageal reflux (GER) and the development of esophageal and aerodigestive complications such as esophagitis, chronic cough, exacerbation of bronchial asthma, and pulmonary aspiration. Work examining the relationship of sleep and GER has captured the attention of gastroenterologists and primary care physicians involved in the treatment of this common, perplexing problem. Sleep results in a significant alteration in basic physiology that can profoundly affect responses to GER.

Sleep is experienced by all mammalian species and is associated with remarkable behavioral and physiological changes. Sleep is a ubiquitous biological need for which the ultimate function, other than restoring behavioral alertness, remains unknown. Accordingly, attempts to understand the basic pathophysiology of GER and its consequences require an understanding and examination of sleep-related reflux events, acid clearance, and arousal responses.

Sleep itself can be divided into five separate stages determined by the simultaneous monitoring of the electroencephalogram, electro-oculogram, and electromyogram, according to internationally accepted criteria. The basic criteria of sleep staging and the fundamental physiology of sleep are outlined elsewhere.¹

Sleep is not merely a passive process; the activation of a variety of brain mechanisms is needed to initiate the onset of sleep. Stage 1 sleep is generally regarded as the transition between waking and sleep. Stages 2, 3, and 4 are generally combined into one entity referred to as non-rapid-eye-movement (NREM) sleep. REM or dreaming sleep occurs at intervals of approximately 90 minutes during a normal night of sleep. The occurrence of

REM sleep is controlled and regulated by specific brainstem nuclei that include the locus ceruleus and several nuclei located in the pontine tegmentum.^{1,2}

Physiologically, NREM sleep is characterized by general slowing of autonomic function, with diminution of heart rate, blood pressure, and metabolic rate. In contrast to NREM, REM sleep is characterized by marked and unique physiological changes. For example, regulation of normal core body temperature is suspended in warm-blooded animals, rendering them poikilothermic.¹ The mechanisms that normally control and regulate blood oxygen, carbon dioxide, and pH are essentially suspended during REM sleep. Furthermore, a complete skeletal-muscle paralysis exists during REM sleep and is generally thought to preclude physically acting out a dream.¹ Thus, the physiological changes associated with sleep may influence nocturnal GER and esophageal acid clearance. (also see figures at end of course)

Responses to Reflux

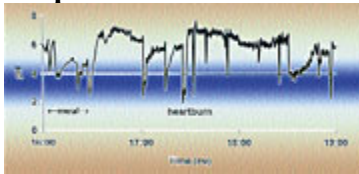


Figure 1. Postprandial reflux during waking.

It is well established that GER is a common postprandial event; in fact, it is a normal physiological response to gastric distension that induces a transient relaxation of the lower esophageal sphincter. Heartburn and regurgitation are also well established as the most common symptoms of esophageal mucosal acid contact. Since the sensation of heartburn is a waking, conscious experience (and many reflux events do not produce symptoms), the actual occurrence of GER during sleep is difficult to estimate based on symptoms alone. GER does occur during sleep, as documented by recent studies,³ but it is clearly less common than GER that occurs in the waking state. It appears that reflux occurs predominantly during NREM sleep, and very rarely during REM sleep. The most frequent occurrence of reflux after sleep onset takes place during episodes of transient arousal. It is not clear what the mechanism of this may be. Classic studies conducted by DeMeester et al⁴ established that GER occurs less commonly during the sleeping interval, and is generally associated with a prolongation of acid clearance. As noted in Figure 1, waking reflux is generally postprandial and reflux events are rapidly cleared (in 1 to 2 minutes). During sleep, however, reflux events are more commonly associated with prolonged acid clearance (Figure 2). Subsequent studies⁵ from our laboratory at the University of Oklahoma have confirmed these findings in that we have demonstrated that the complications of reflux that result in discontinuity of the esophageal mucosa are generally associated with an increase in supine GER during sleep.

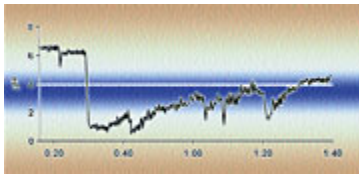


Figure 2. Sleep-related reflux. A single event may last 15 to 20 minutes.

Sensory Response

What is occurring during sleep that leads to this marked prolongation in acid clearance? Several secretory, motor, and sensory responses are associated with acid mucosal contact in the human esophagus.

Typically, acidification of the distal esophagus will produce a marked increase in salivary flow. This allows ample buffering to neutralize the acidic lining of the distal esophagus. There is also a marked increase in the rate of swallowing that allows the delivery of the potent buffer of saliva into the distal esophagus. In addition, swallowing and the subsequent primary peristaltic contractions of the esophagus allow the efficient removal of the refluxant from the distal esophagus. In addition, the esophagus has an endogenous mechanism that also produces a peristaltic response to deformation or noxious mucosal stimulation. This is called secondary peristalsis, since it does not require a preceding swallow to initiate the peristaltic response. Of course, acid mucosal contact is associated with a sensation of substernal burning that is perceived as uncomfortable and/or painful. These responses have been determined to be present in a normal waking individual, and swallowing and heartburn are generally assumed to be waking, conscious phenomena. Collectively, these responses generally result in rapid clearance of refluxed gastric contents and neutralization of the acidic mucosa.

These typical responses in the waking state are generally absent during sleep. It is clearly these alterations that result in the marked prolongation of acid clearance noted during sleep. A study⁶ from our laboratory has demonstrated that the simple infusion of acid into the distal esophagus during polygraphically monitored sleep results in a highly significant prolongation of acid clearance time, compared with infusion in the supine waking state. Adding to the risks associated with reflux during sleep is the fact that the swallowing rate is markedly diminished and salivary flow is essentially absent. Heartburn is clearly absent during sleep. Thus, these alterations establish a significant risk for the prolongation of acid mucosal contact during sleep. In a series of studies using a rabbit esophageal model, Johnson and Harmon⁷ have documented that the back diffusion of hydrogen ions into the esophageal mucosa is directly related to the duration of esophageal acid-contact time. The longer the acid-contact time, the greater the back diffusion of hydrogen ions. Short, rapidly cleared episodes of GER would appear to be relatively benign, while more prolonged episodes of GER are associated with greater risk of mucosal damage. An additional risk of prolonged acid mucosal contact relates to the higher risk of the proximal migration and eventual spillover of refluxed gastric contents into the tracheobronchial tree. A recent study⁸ from our laboratory relates directly to the risk of sleep in facilitating the proximal migration of very small volumes of acid infused into the distal esophagus. In this study, small (1-mL and 3-mL) volumes of acid were instilled into the distal esophagus during supine waking and sleep. We noted that none of the waking volunteers showed evidence of proximal migration of 1 mL of acid. During sleep, however, 40% of the same individuals showed evidence of the proximal migration of 1 mL of acid infused during polygraphically determined NREM sleep. Thus, it can be concluded that sleep itself induces considerable risk of prolonged acid mucosal contact, and it facilitates the occurrence of proximal migration of acid, enhancing the probability of pulmonary aspiration.

Studies⁹ from our laboratory have determined that the potential complications of sleep-related esophageal acid mucosal contact are mitigated by the occurrence of an awakening from sleep, or arousal response. We have determined that acid clearance is inversely related to the amount of wakefulness during the acid clearing.

Individuals who tended to sleep through episodes of esophageal acid infusion had longer acid-clearance times, and those who had a rapid arousal response with prolonged awakening had shorter acid-clearing times. Maintaining sleep in response to an episode of GER would appear to be quite maladaptive. This creates a paradox: to provide an appropriate response to GER during sleep, a brief awakening from sleep is required. This arousal need only be for a short time, but it appears to be necessary to avoid the ultimate consequences of sleep-related GER. A sleep disturbance results in a more adaptive response to GER.

Nighttime GER can lead to the development of esophagitis, as well as to other respiratory complications such as exacerbation of asthma symptoms and chronic cough. These complications appear to be related primarily to the presence of significant supine acid-contact time during sleep. Nighttime reflux, with its associated delayed esophageal acid clearance, also may be a risk factor for respiratory symptoms, although the pathophysiology of this is not well established. In one study,¹⁰ for example, a large percentage of patients with idiopathic pulmonary fibrosis were found to have GER. Aspiration was noted as the likely cause. A high percentage of patients with chronic bronchitis were found to have GER and prolonged reflux episodes.¹¹ Several studies¹²⁻¹⁴ of patients with obstructive sleep apnea have not shown a direct correlation between GER and obstructive apneic events. For example, Ing et al¹³ have shown that only 18% of reflux events were associated with obstructive apnea in a group of patients with polysomnographically documented obstructive apnea. Total acid-contact time was elevated, however, in comparison with a control group of individuals without significant obstructive apnea. There does appear to be a relationship between obstructive sleep apnea and an overall increase in nighttime acid contact.¹²⁻¹⁴

Clinical Manifestations

Symptom control and quality of life remain important issues in the treatment of GER. The most common symptoms, heartburn and regurgitation, have been regarded almost exclusively as daytime phenomena, and nighttime manifestations have been largely ignored until quite recently. Two recent studies^{15,16} have documented the importance of nighttime symptoms and their effect on the overall quality of life of heartburn patients, as well as indicating the presence of other important extraesophageal symptoms. These studies revealed remarkably similar results with approximately 75% of those with frequent heartburn admitting to significant symptoms at night, with the overall prevalence rate for nighttime symptoms estimated at approximately 10%. These studies provide considerable evidence that the sequelae of GER appear to be more severe in patients with nighttime symptoms. Patients with nighttime symptoms have a substantially diminished quality of life compared to individuals without nighttime symptoms.¹⁶ The quality-of-life scores of patients with nighttime heartburn show significant decreases in both physical and mental components such as pain, general health, and social functioning. These patients also show diminished quality of life, compared with patients with diabetes and angina.

An important component of the decreased quality of life noted in patients with nighttime heartburn appears to come from the fact that it interferes with the quality of sleep. More than 50% of those with nighttime heartburn report that they are awakened by GER symptoms, and about 30% are awakened by coughing or choking due to regurgitation. About 40% of patients with nighttime symptoms noted that their heartburn affected their ability to function well the next day, and about 60% indicated that it affected their mood. The use of sleeping pills was also substantially increased in patients with nighttime GER symptoms.^{15,16}

GER, especially at night, has been implicated in the etiology of a variety of aerodigestive symptoms such as wheezing, chronic cough, and hoarseness.^{12,17} Reflux symptoms appear to be quite prevalent in patients with asthma; in one study of asthma patients, 77% complained of heartburn, 41% experienced reflux-associated respiratory symptoms, 82% had abnormal esophageal acid-contact times, and 43% manifested esophagitis upon endoscopy.¹⁸ It has been established that nighttime reflux in asthma can induce bronchoconstriction that appears to be related to the duration of the reflux event.¹⁹ In addition, it has been shown that a reduction in asthma symptoms occurs after GER treatment, which supports the notion that reflux can exacerbate asthma.²⁰ Additional support for the relationship between nighttime reflux and asthma comes from epidemiological studies²⁰ that have shown that asthma and other respiratory symptoms strongly coincide in patients who have nighttime heartburn at least twice a week.²¹

Nighttime Heartburn

Nighttime GER symptoms not only appear to be more bothersome to patients, but are more difficult to control than daytime symptoms. While most patients with nighttime GER took medication for their problem, 45% had continuing symptoms in one study.¹⁵ Patients with symptoms of nighttime GER sometimes find relief by elevating the head of the bed, changing their sleeping position to the left side, and not eating within 3 hours of bedtime. Elevating the head of the bed appears to facilitate acid clearance rather than prevent reflux.

Clearly, proton pump inhibitors (PPIs) are the most effective acid-suppressing agents, and are therefore more likely to render gastric contents less injurious to the esophageal mucosa.²²⁻²⁴ For that reason, PPIs are of significant therapeutic benefit in relieving symptoms and healing esophagitis.

Although PPIs have overwhelming therapeutic efficacy in healing esophagitis and relieving symptoms, some patients do have nighttime symptoms despite powerful acid suppression and a marked reduction in GER. The reflux of gastric contents is not eliminated by acid suppression and, in some instances, the reflux of less acidic gastric contents can persist, without warning. Clinically, this may be noticed in patients who report that PPIs diminish their nocturnal heartburn, but that they continue to experience unexplained awakenings from sleep with symptoms of coughing and choking. This should be a warning to the clinician that significant nonacidic reflux may be occurring, or that there is inadequate reduction in GER during the sleeping interval. In such

circumstances, the most rational approach is to take the PPI twice daily, with the second dose occurring before the evening meal.

Conclusions

There is considerable evidence linking nighttime reflux with severe esophageal damage, respiratory complications, and decrements in quality of life. Sleep disturbances that occur with nocturnal reflux may have serious consequences for the general well-being of patients and their ability to perform well at work or in other roles the next day. Thus, frequent nighttime GER symptoms should not be considered simply an annoyance, but a chronic ailment with insidious detrimental effects on health and quality of life. GER symptoms are more noxious during the sleeping interval and are more difficult to control. Thus, it behooves the clinician to be aware of symptoms associated with the presence of nocturnal reflux, as well as appropriate treatment modifications that may be required to treat nocturnal symptoms effectively. PPIs are the drugs of choice, and there are considerable data to suggest that these drugs effectively control both daytime and nighttime symptoms.

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Normal Postprandial Reflux (in Normal Volunteer)

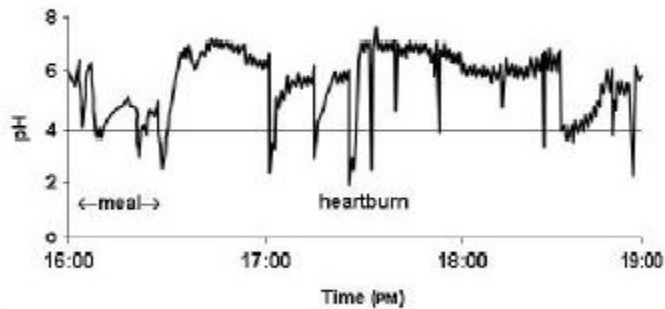


Fig. 1 - Post-prandial reflux during waking.

Sleep Reflux Supine Sleep Condition

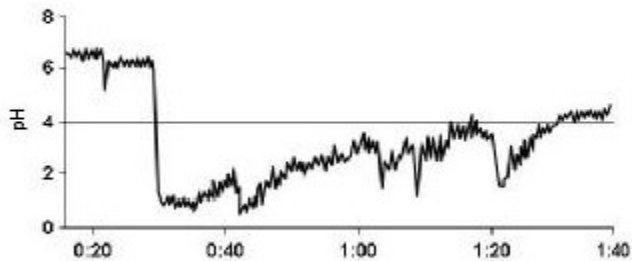


Fig. 2 - Sleep related reflux. A single event may last 15-20 minutes.

Normal Defense Mechanisms Against Acid Load

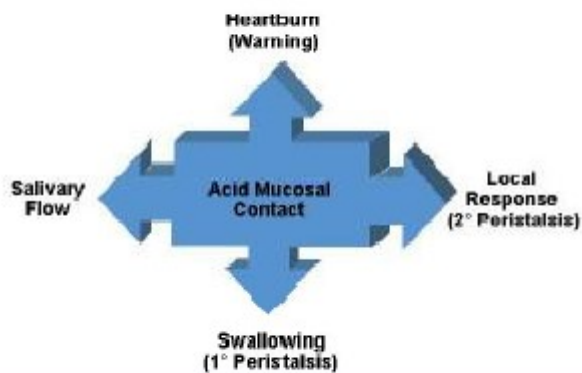


Fig. 3 - Schematic diagram of responses to acid/mucosal contact in the waking state.

Acid-Mucosal Response

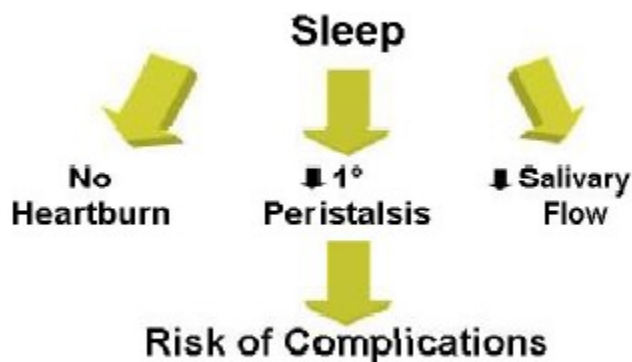


Fig. 4 - Schematic diagram of altered responses noted to sleep related gastroesophageal reflux.

Measure	Pre PDI (mean \pm SD)	PostPDI (mean \pm SD)
Prox. resting pressure (cmH ₂ O)	-2 (4)	1 (4)
Distal resting pressure (cmH ₂ O)	-1 (5)	-2 (4)
Proximal amplitude (cm H ₂ O)	52 (18)	54 (26)
Distal amplitude (cmH ₂ O)	68 (24)	65 (26)
% Proximal peristalsis	64 (37)	78 (27)
% Distal peristalsis	72 (32)	83 (18)
% Study time pH < 4	2.9 (4.8)	1.1 (1.3)

Results:

Method	Mean pressures ±SE Start (mm Hg) ¹	Mean pressures±SE End (mm Hg)	Correlation coefficient (r)
SPT	23.3 ±1.73 ^{1,2}	28.2 ±1.88	0.53*
RPT	13.1 ±0.77	12.8 ±0.7	0.58*
DS	19.7 ±1.2	11.9 ±1.3	0.66*

+ANOVA f=27.4; p<0.0001; SPT vs. RPT (Scheffe F= 15.98, p< 0.05) 2SPT vs. DS (Scheffe F= 27, p< 0.05) Paired measurements (start vs. end) by each test were significantly correlated (*p <0.001, Table) but r values were only 0.53 - 0.66. Correlation coefficient (r)

Some Seldom Discussed Complications of Gastroesophageal Reflux

By: W. Grant Thompson M.D., Emeritus Professor of Medicine, University of Ottawa

The common consequences of acid from the stomach refluxing upwards into the unprotected esophagus. These include heartburn, unexplained chest pain (non-cardiac chest pain), and inflammation and scarring of the lower esophagus (esophageal stricture) leading to swallowing difficulty. There has also been much written about chronic changes wrought by chronic reflux of gastric contents into the lower esophagus that are known as Barrett's esophagus and thought to indicate a risk of subsequent cancer. However, here we will deal with several seldom-described consequences of GERD that are not rare and which can cause great distress in their own right.

Sore Throat, Cough

Awakening with a sore throat and cough is not always a harbinger of the common cold. Nocturnal reflux, especially after late-night food or alcohol intake, may reach the throat without awakening the individual. The refluxed gastric contents irritate sensitive tissues causing a sore throat, a need to "clear the throat," and cough. There are other causes of course, such as dry environments, or allergies. However, if due to reflux, the sore throat and cough is easily prevented by avoiding late night eating and drinking, and employing other anti-reflux measures.

Nocturnal Choking

Some people awake an hour or so after retiring with attacks of choking and retching. Acid and sometimes food appear in the throat and there is severe burning. Heartburn may or may not be present. Here again late-night rich food and revelry may load the stomach, and the reclining position during sleep sets the stage for food and acid to reflux all the way to the throat. These attacks are distressing and the burning throat may take hours to settle down.

Particularly prone to this type of attack are people suffering from sleep apnea. In this condition, deep sleep causes the tissues around the throat to collapse so the sleeper must breathe in through an obstructed airway. The most common and best-known manifestation of sleep apnea is snoring. More subtle signs are daytime sleepiness and high blood pressure. What concerns us here is that the forced inhalation required to try to overcome the obstructed airway may inadvertently suck gastric contents up the

esophagus and into the throat. In addition to retiring with an empty stomach and employing other anti-reflux measures, such patients are dramatically helped by treatment of the sleep apnea. This usually involves the use of a positive airway pressure machine (c-PAP), which through a facemask maintains sufficient pressure to keep the airway open during sleep.

Aspiration Pneumonia

Debilitated or elderly patients may have reduced sensitivity in the throat. This may reduce the usual anti-reflux defenses and permit some individuals to breath in (aspirate) regurgitated material into their lungs. The result is a chemical pneumonia quickly followed by infection with opportunistic organisms. Patients with reduced consciousness are very prone to aspirate, but in ambulatory persons it is rare. Aspiration pneumonia may be difficult to treat because of the unusual organisms that invade the damaged lungs, and continued aspiration may occur if the condition is unrecognized. Aspiration is a particular danger when elderly or semi-conscious patients undergo tests requiring insertion of a tube into the esophagus such as endoscopy, and is one reason why the procedure must be done after fasting and with careful monitoring.

Asthma

There is an interesting relationship between non-allergic (non-seasonal) asthma and gastroesophageal reflux. Respiratory symptoms such as coughing or wheezing produce reflux by sudden, violent changes in the intra-abdominal and intra-thoracic pressures. Reflux also may occur during the deep inhalation taken before forceful exhalation by an asthmatic. Conversely, acid reflux irritates the larynx and may cause a reflex constriction of the bronchi.

In an individual, it is difficult to prove that reflux causes asthma. The best proof is improvement of both reflux and asthma with effective anti-reflux therapy. In one study, both anti-reflux surgery and the anti-acid H₂ blocking drug cimetidine improved asthma. While the surgery-treated patients remained better 5 years later, those given cimetidine relapsed when use of the drug was ceased. Thus, if reflux is suspected as a cause of non-allergic asthma, the sensible course is to intensively treat the effects of reflux by reducing the acidity of the refluxed material. Today, a proton pump inhibitor (PPI) would be the drug of choice.

Acid Laryngitis

Occasionally, gastric juice may reflux through the esophagus and upper esophageal sphincter and spill into the larynx, or voice box. The ensuing inflammation of the posterior larynx causes laryngitis and hoarseness. Acid may be detected in the larynx in some reflux episodes, and damage to the larynx is sometimes visible through a scope. Diagnosis may be difficult. There may be no heartburn to warn the individual of a reflux episode. Just as the esophagus may look normal in a person with heartburn, so laryngitis may occur with a normal appearing larynx.

Symptoms include hoarseness, persistent nonproductive cough, and a need to continually clear the throat. Some individuals feel that something is stuck in the throat. Some patients

improve using a PPI. More importantly, the individual should undertake the lifestyle changes necessary to minimize reflux.

Dental Erosions

Regurgitation of acid into the mouth can cause dental erosions. It seems remarkable that such reflux could occur without serious esophageal symptoms leading to preventative action. Nevertheless, apparently nocturnal reflux of gastric acid can damage the enamel of teeth. Unlike dental caries (cavities), the damage occurs on the exposed surfaces of the tooth.

Reflux Dyspareunia

In a study of 100 Glasgow women, 77 reported having heartburn during intercourse. This phenomenon may be more common than publicly admitted. Clearly the recumbent position on a full stomach is ill advised. The Scottish researchers recommended weight loss, avoidance of stooping, and the "female-superior position" which they claim improved 61 of their 77 subjects.

Misdiagnosis

Because of poor communication or a genuine misperception, physicians may mistake heart pain for heartburn and lose an opportunity for life-prolonging therapy. Usually coronary pain (angina) is a characteristic retrosternal pressure, squeezing, or heaviness that occurs with exertion. Sufferers often know their exact limits and are able to prevent angina by measured exertion. Cold air also causes angina. Heart pain is usually centered in the breast, and the discomfort sometimes extends up into the neck and inside the left arm. The lower esophagus lies just behind the heart, so it is not surprising that the pain distribution of GERD is similar to that of angina. When these two conditions occur together, interpretation is doubly difficult.

Vigorous exercise may provoke reflux as well as angina. Nonetheless, most patients recognize the burning and position-related nature of their heartburn. While mistaking angina for heartburn is the more serious error, mistaking esophageal pain for angina is more common, and can produce much worry. This is sometimes known as "non-cardiac chest pain." Imprecise history taking can also cause confusion between heartburn and dyspepsia, biliary colic, or pains in the chest muscles or in the joints where the ribs attach to the breastbone.

Treatment

The best treatment of these lesser-known complications of GERD is the rigorous prevention of reflux through measures described in other issues of *Digestive Health Matters*. While acid reducing drugs such as the H₂ blocking agents (e.g., ranitidine, famotidine, cimetidine, nizatidine) and proton pump inhibitors (e.g., omeprazole, lansoprazole, rabeprazole, pantoprazole) are helpful, they only reduce the acidity of the refluxed material. Other refluxed substances may also cause many of the conditions described above. The importance of letting a meal digest and move out of the stomach before retiring cannot be overemphasized.

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Sleep Apnea Treatment Effective for Gastroesophageal Reflux

Doctors at Duke University Medical Center and the University of South Alabama have found that a positive-pressure method commonly used to treat obstructive sleep apnea (OSA) also alleviates symptoms of nocturnal gastroesophageal reflux (nGER) in many patients suffering from both disorders.

The results of their study are published in the January 13, 2003, issue of the *Archives of Internal Medicine*. The researchers believe that the treatment, called continuous positive airway pressure (CPAP), likely alleviates nGER by preventing acid from regurgitating from the stomach.

"This is the first long-term, prospective study of the relationship between obstructive sleep apnea and nocturnal gastroesophageal reflux, and specifically the efficacy of a proven sleep apnea treatment in reducing reflux symptoms," said John O'Connor, MD, assistant professor of medicine in the division of gastroenterology at DUMC.

Nocturnal gastroesophageal reflux is a common condition characterized by disturbance of sleep due to severe heartburn and regurgitation of acidic stomach fluid into the esophagus. Patients with OSA repeatedly stop breathing for periods of 10 seconds or longer while sleeping.

Experts estimate that 10 percent of the general population experiences nGER. However, studies have shown that a much larger percentage of OSA patients—between 54 and 76 percent—also suffer from nGER.

Doctors diagnose OSA through polysomnography, a procedure performed overnight in a sleep lab to evaluate sleep disruption. While the patient sleeps, the machine tallies the total number of times the patient's breathing either stops or slows, to come up with a measure of the severity of the patient's OSA.

In the study, patients arriving to be tested for OSA were asked to report the frequency with which their sleep was disturbed by "severe heartburn and choking."

Of the 331 patients surveyed, 61 percent reported symptoms of nGER. The researchers followed 189 of those patients who were treated with nasal continuous positive airway pressure (CPAP) to relieve OSA.

CPAP is the standard treatment for sleep apnea and is administered through a mask fitted over the nose worn during sleep. The mask attaches to a machine that delivers pressurized air through the patient's nostrils. The pressure maintains an open air-way, thus preventing any interruptions in breathing. Although CPAP relieves sleep apnea, it does not cure the disorder and must be used every night to be most effective.

Physicians believe CPAP also prevents nGER symptoms by increasing pressure in the thorax and thus preventing acid from coming back up the esophagus.

The Duke researchers followed up with each patient to assess the frequency of his or her nGER symptoms while using CPAP treatment. CPAP treatment resulted in a 48 percent overall decrease in the frequency of patients' nGER symptoms.

"Nocturnal reflux problems can be quite disturbing to patients who suffer from this disorder," said O'Connor. "And we know that nighttime reflux is even more detrimental to patient quality of life than daytime heartburn. Although our study demonstrated that CPAP treatment relieved both sleep apnea and GERD symptoms, there needs to be further research to determine the optimal treatment combination including CPAP, dietary modifications, and acid suppressing medications."

Joining O'Connor on this study were Bryan Green, MD, a fellow in the division of gastroenterology at DUMC, and William Broughton, MD, professor of medicine at the University of South Alabama College of Medicine.

FAQs

What is GERD (acid reflux)?

Gastroesophageal reflux disease, commonly referred to as GERD, or acid reflux, is a condition in which the liquid content of the stomach regurgitates (backs up, or refluxes) into the esophagus. The liquid can inflame and damage the lining of the esophagus although this occurs in a minority of patients. The regurgitated liquid usually contains acid and pepsin that are produced by the stomach. (Pepsin is an enzyme that begins the digestion of proteins in the stomach.) The refluxed liquid also may contain bile that has backed-up into the stomach from the duodenum. (The duodenum is the first part of the small intestine that attaches to the stomach.) Acid is believed to be the most injurious

component of the refluxed liquid. Pepsin and bile also may injure the esophagus, but their role in the production of esophageal inflammation and damage (esophagitis) is not as clear as the role of acid.

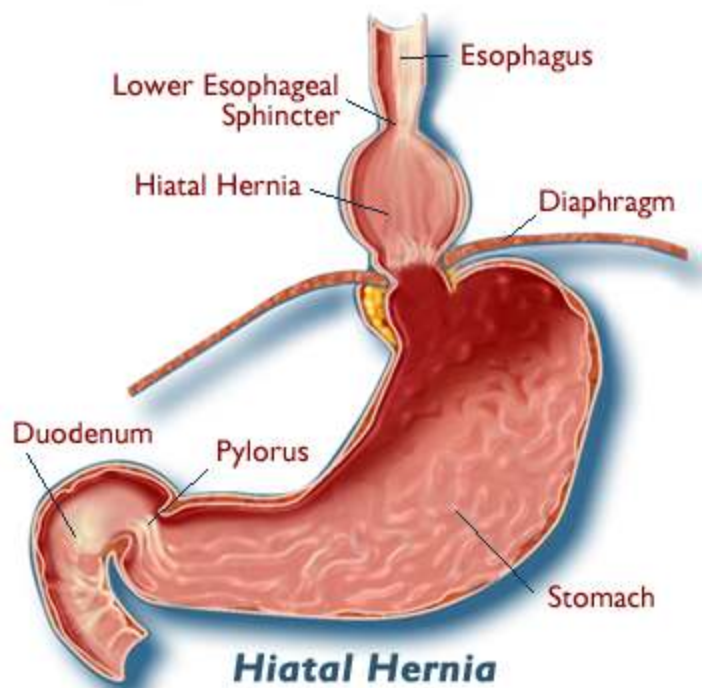
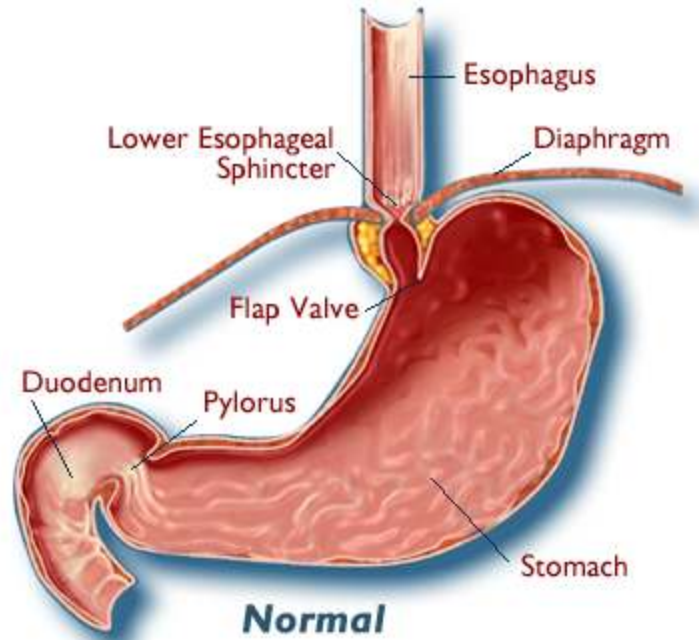
GERD is a chronic condition. Once it begins, it usually is life-long. If there is [injury](#) to the lining of the esophagus (esophagitis), this also is a chronic condition. Moreover, after the esophagus has healed with treatment and treatment is stopped, the injury will return in most patients within a few months. Once treatment for GERD is begun, therefore, it usually will need to be continued indefinitely.

Actually, the reflux of the stomach's liquid contents into the esophagus occurs in most normal individuals. In fact, one study found that reflux occurs as frequently in normal individuals as in patients with GERD. In patients with GERD, however, the refluxed liquid contains acid more often, and the acid remains in the esophagus longer.

As is often the case, the body has ways (mechanisms) to protect itself from the harmful effects of reflux and acid. For example, most reflux occurs during the day when individuals are upright. In the upright position, the refluxed liquid is more likely to flow back down into the stomach due to the effect of gravity. In addition, while individuals are awake, they repeatedly swallow, whether or not there is reflux. Each swallow carries any refluxed liquid back into the stomach. Finally, the salivary glands in the mouth produce saliva, which contains bicarbonate. With each swallow, bicarbonate-containing saliva travels down the esophagus. The bicarbonate neutralizes the small amount of acid that remains in the esophagus after gravity and swallowing have removed most of the liquid.

Gravity, swallowing, and saliva are important protective mechanisms for the esophagus, but they are effective only when individuals are in the upright position. At night while sleeping, gravity is not in effect, swallowing stops, and the secretion of saliva is reduced. Therefore, reflux that occurs at night is more likely to result in acid remaining in the esophagus longer and causing greater damage to the esophagus.

Certain conditions make a person susceptible to GERD. For example, GERD can be a serious problem during [pregnancy](#). The elevated hormone levels of pregnancy probably cause reflux by lowering the pressure in the lower esophageal sphincter (see below). At the same time, the growing fetus increases the pressure in the abdomen. Both of these effects would be expected to increase reflux. Also, patients with diseases that weaken the esophageal muscles (see below), such as [scleroderma](#) or mixed connective tissue diseases, are more prone to develop GERD.



What causes GERD?

The cause of GERD is complex. There probably are multiple causes, and different causes may be operative in different individuals or even in the same individual at various times. A small number of patients with GERD produce abnormally large amounts of acid, but this is uncommon and not a contributing factor in the vast majority of patients. The

factors that contribute to causing GERD are the lower esophageal sphincter, [hiatal hernias](#), esophageal contractions, and emptying of the stomach.

Lower esophageal sphincter

The action of the lower esophageal sphincter (LES) is perhaps the most important factor (mechanism) for preventing reflux. The esophagus is a muscular tube that extends from the lower throat to the stomach. The LES is a specialized ring of muscle that surrounds the lower-most end of the esophagus where it joins the stomach. The muscle that makes up the LES is active most of the time. This means that it is contracting and closing off the passage from the esophagus into the stomach. This closing of the passage prevents reflux. When food or saliva is swallowed, the LES relaxes for a few seconds to allow the food or saliva to pass from the esophagus into the stomach, and then it closes again.

Several different abnormalities of the LES have been found in patients with GERD. Two of them involve the function of the LES. The first is abnormally weak contraction of the LES, which reduces its ability to prevent reflux. The second is abnormal relaxations of the LES, called transient LES relaxations. They are abnormal in that they do not accompany swallows and they last for a long time, up to several minutes. These prolonged relaxations allow reflux to occur more easily. The transient LES relaxations occur in patients with GERD most commonly after meals when the stomach is distended with food. Transient LES relaxations also occur in individuals without GERD, but they are infrequent.

Gastroesophageal Reflux Disease (GERD) and Asthma

GERD has been recognized as a significant contributor to asthma and asthma symptoms.

Gastroesophageal Reflux Disease (GERD) is the reversed flow of gastric secretions from the stomach into the esophagus. Normally the lower esophageal sphincter at the base of the esophagus prevents this. A weakening or inefficient closure of this valve permits gastric contents to move back up the esophagus.

Symptoms

The highly acid properties of gastric secretions cause burning of the delicate tissues of the esophagus and produce the characteristic symptoms of a burning sensation behind the sternum, regurgitation into the mouth, difficulty in swallowing and breathing, and chest pain.

There is also a "Silent" or asymptomatic form of GERD. This form can result in an unexplained cough, sore throat, or hoarseness when the person wakes up. This "silent" form can also exacerbate asthma.

Diagnosis

There are a number of diagnostic tools used by clinicians to diagnose GERD. They include barium swallows to document reflux into the midesophagus or higher. A 24 hour pH monitoring, typically by inserting a small probe through the nose and into the esophagus. The probe remains in place for 24 hours and readings and events are recorded automatically and manually by the patient. Lastly, by endoscopy, similar to a bronchoscope, which uses a fiber optic "tube" that is inserted via the mouth and gives the physician a direct look at the esophagus. This last method is very important in evaluating "silent" GERD by looking for irritation in the lower esophagus. The [GERD Information Resource Center](#) has a detailed look at what the physician sees through the endoscope.

Treatment

There are currently two approaches to the treatment of GERD. The first and most common is by medication. Medications such as antacids, alginic acid compounds, H2-blockers, cisapride, and omeprazole have been found to be effective. An article from [Therapeutics Initiative, University for British Columbia](#) has very complete listings of medications, costs, and how the medication treats GERD.

The other means of treating GERD is surgically. Surgical procedures have improved in recent years to reduce hospital length of stay, overall recovery time, and complications. Fundoplication surgery can be done using one of two different approaches. The stomach can be accessed either through the chest or abdomen, the chest approach used for patients who are over weight or has a short esophagus. If open surgery is done, several days may be needed in the hospital for post-op recovery. Full recovery may take as long as 6 weeks. If the surgery is done laparoscopically, recovery is significantly reduced. Patients can return to work in as little as one week. WebMD has a good overview of [fundoplication surgery](#).

Effects

GERD can exacerbate asthma symptoms. The reason why this occurs is still being debated. The two schools of thought at the moment lean toward microaspiration of stomach contents, usually during sleep, and a vagal response from the lower end of the esophagus. The vagal response is important in that it effects asthma even if symptoms of GERD are not grossly apparent. A combination of the two is also very likely.

Another important effect of GERD, especially if left untreated, is the increased risk of esophageal cancer. GERD can produce a condition known as Barrett's esophagus which is of changes in the epithelial cells lining the esophagus. This is a pre-cancerous condition and if caught early is treatable. About 10 to 20% of people with chronic GERD will develop Barrett's esophagus.

GERD can effect people of any age from infancy to adults. New onset of asthma in middle age or older should raise suspicion of GERD.

Reducing Symptoms

There are some simple ways to reduce GERD symptoms without medication or surgery, here they are:

- 1. Elevate your head six to eight inches when sleeping
- 2. Stop eating after you finish your evening meal
- 3. Wait at least two to three hours after meals before lying down
- 4. Don't exercise hard or do any prolonged bending after meals
- 5. Don't wear tight fitting clothes
- 6. Avoid constipation
- 7. Don't drink large amounts of carbonated beverages, coffee (including decaffeinated) and/or alcohol
- 8. Stay away from very fatty foods, chocolate and foods you know cause you discomfort.
- 9. Don't stuff yourself at a single meal
- 10. Stop smoking
- 11. Lose weight, try to maintain your ideal body weight
- 12. Talk to your doctor about symptoms and possible treatment.

Gastroesophageal Reflux Disease

Gastroesophageal reflux disease (GERD) is a disorder of the esophagus that causes frequent symptoms of [heartburn](#). The esophagus is the tube connecting the mouth to the stomach. GERD occurs when a muscular ring called the lower esophageal sphincter (LES) is weakened, which permits irritating stomach contents to pass up into the esophagus, resulting in heartburn. Sometimes regurgitation of acid and food as high as the mouth can occur. Chronic irritation of the esophagus by stomach acid can eventually cause ulceration and scarring and might lead to [cancer](#) of the esophagus, especially in people who smoke and/or consume large amounts of [alcohol](#).¹

Checklist for GERD

Rating	Nutritional Supplements	Herbs
★☆☆		Licorice
★☆☆	Digestive enzymes	Aloe vera

	Hydrochloric acid	Bladderwrack Marshmallow Slippery elm
<p>★★★★ Reliable and relatively consistent scientific data showing a substantial health benefit.</p> <p>★★★☆☆ Contradictory, insufficient, or preliminary studies suggesting a health benefit or minimal health benefit.</p> <p>★☆☆☆☆ An herb is primarily supported by traditional use, or the herb or supplement has little scientific support and/or minimal health benefit.</p>		

What are the symptoms of GERD? People with GERD have heartburn, which usually feels like a burning pain that begins in the chest and may travel upward to the throat. Many people also feel a regurgitation of stomach contents into the mouth, leaving an acid or bitter taste. Some people with GERD may also have coughing while lying down, increased production of saliva, and difficulty sleeping after eating.

How is it treated? Conventional treatment consists of the avoidance of stomach acid stimulants (e.g., [coffee](#), alcohol), certain drugs (e.g., anticholinergics), specific foods (fats, chocolate), and smoking. Medications may also be prescribed to control stomach acidity which include histamine H2 inhibitors (e.g., [cimetidine](#) [Tagamet®], [famotidine](#) [Pepcid®], [nizatidine](#) [Axid®], [ranitidine](#) [Zantac®]), proton pump inhibitors (e.g., [lansoprazole](#) [Prevacid®], and [omeprazole](#) [prilosec®]), and [antacids](#) (e.g., Maalox®, Mylanta®, Rolaids®, and Tums®).

Dietary changes that may be helpful: Whether lowering dietary fat is important for people with GERD is somewhat unclear. Historically, [low-fat diets](#) have been recommended to patients with GERD because fatty foods appeared to be associated with increased heartburn and fatty foods had been shown to weaken the LES in both healthy people and people with GERD.^{2 3} A number of recent studies, however, have found no correlation between the fat content of a meal and subsequent symptoms of heartburn and reflux.^{4 5} Another study found that hospitalizations due to GERD were no more likely for people who ate high-fat diets than for those on low-fat diets.⁶ One study compared different fast foods for their likelihood to cause reflux symptoms and found that chili and red wine caused more symptoms than higher-fat foods such as hamburgers and French fries.⁷

Eating foods or drinking beverages flavored with spearmint, [peppermint](#), or other spices with strong aromatic oils causes relaxation of the LES and can contribute to symptoms in people with GERD.⁸ Chocolate also relaxes the LES and can cause [heartburn](#).^{9 10} Acidic beverages like [juices](#), [coffee](#), and [tea](#) have also been linked to increased heartburn pain, as have carbonated drinks, [alcohol](#), and [milk](#).¹¹

Infants who suffer from GERD may have a true allergy to cows' milk.¹² Some small studies estimate that milk allergy is a cause in about 20% of infants with GERD,^{13 14 15} but a larger study of 204 infants with GERD diagnosed cows' milk allergies in 41%.¹⁶ For these infants, reflux symptoms improved with elimination of milk products from the diet. Some researchers advise a trial of cows' milk-elimination in all infants suffering

from GERD.^{17 18} Infants with a condition known as multiple food protein intolerance in infancy (MFPI) have been shown to have a high incidence of GERD and may only improve when amino-acid based formula is used in place of other formulas.^{19 20}

Lifestyle changes that may be helpful: Smoking weakens the LES and is a strong risk factor for GERD.^{21 22 23} A study of infants with GERD found that exposure to cigarette smoke in the environment is associated with reflux, leading the authors conclude that secondhand smoke contributes directly to GERD in infants.²⁴ No similar studies on environmental smoke have been done with adults. Psychological stress and alcohol have also been shown to be associated with the weakening of the LES and symptoms of GERD.^{25 26 27 28}

A number of studies have found that [obesity](#) increases the risk of GERD,^{29 30} though one study found no association between severe obesity and GERD.³¹ Obese people tend to have weaker sphincters,³² and they more often develop a condition related to GERD called hiatal hernia, in which the upper part of the stomach protrudes above the diaphragm, resulting in a deformed LES.³³ It has been suggested that obesity may contribute to GERD by increasing abdominal pressure, but this mechanism has not been proven.³⁴ The benefit of weight loss for obese patients with GERD is controversial. Some researchers have found that symptoms of GERD are reduced with weight loss,³⁵ while others have seen no change with weight loss and even increased symptoms in patients with massive weight loss.³⁶

Lying down prevents gravity from keeping the stomach contents well below the opening from the esophagus. For this reason, many authorities recommend that people with GERD avoid lying down sooner than three hours after a meal, and suggest elevating the head of the bed to prevent symptoms during sleep.^{37 38}

GERD occurs more frequently during exercise than at rest, and can be a cause of chest pain or abdominal pain during exertion.³⁹ One study found that increased intensity of exercise resulted in increased reflux in both trained athletes and untrained people.⁴⁰ In another study, running produced more reflux than less jarring activities, such as bicycling, while weight training produced few reflux symptoms.⁴¹ Eating just before exercise has been found to further aggravate GERD.^{42 43} On the other hand, a recent survey found that people who participate in little recreational activity were more likely than active people to be hospitalized for GERD.⁴⁴ It makes sense for people with GERD to use exercise as part of a healthy lifestyle, perhaps choosing activities that are less likely to cause reflux symptoms.

Nutritional supplements that may be helpful: [Hydrochloric acid](#) and [digestive enzymes](#) are sometimes recommended by practitioners of natural medicine in the hope improved digestion will help prevent reflux.⁴⁵ However, these therapies have not been researched for their effectiveness.

Are there any side effects or interactions? Refer to the individual supplement for information about any side effects or interactions.

Herbs that may be helpful: [Licorice](#), particularly as chewable deglycyrrhizinated licorice (DGL), has been shown to be an effective treatment for the healing of stomach and duodenal [ulcers](#);^{46 47 48} in an uncontrolled trial, licorice was effective as a treatment for aphthous ulcers ([canker sores](#)).⁴⁹ A synthetic drug similar to an ingredient of licorice has been used as part of an effective therapy for GERD in both uncontrolled⁵⁰ and double-blind^{51 52} trials. In a comparison trial, this combination proved to be as effective as [cimetidine](#) (Tagamet®), a common drug used to treat GERD.⁵³ However, licorice itself remains unexamined as a treatment for GERD.

Other herbs traditionally used to treat reflux and [heartburn](#) include digestive demulcents (soothing agents) such as [aloe vera](#), [slippery elm](#), [bladderwrack](#), and [marshmallow](#).⁵⁴ None of these have been scientifically evaluated for effectiveness in GERD. However, a drug known as Gaviscon®, containing magnesium carbonate (as an antacid) and alginic acid derived from bladderwrack, has been shown helpful for heartburn in a double-blind trial.⁵⁵ It is not clear whether whole bladderwrack would be as useful as its alginic acid component.

Are there any side effects or interactions? Refer to the individual herb for information about any side effects or interactions.

More on GERD

GERD BASICS:

GERD, also known as acid reflux, is an acronym that stands for gastroesophageal reflux disease. It is a chronic illness that affects 5-7% of the world population and is associated with serious medical complications if untreated. GERD is the 3rd most common gastrointestinal disorder in the US. Most patients with GERD also experience nighttime heartburn, which is more bothersome. And according to the 2001 NSF *Sleep in America* poll, adults in America who experience nighttime heartburn are more likely to report having symptoms of sleep problems/disorders such as insomnia, sleep apnea, daytime sleepiness and restless legs syndrome than those who don't have nighttime heartburn.

GERD describes a backflow of acid from the stomach into the esophagus. Most patients with GERD experience an increase in the severity of symptoms (usually heartburn or coughing and choking) while sleeping or attempting to sleep. If the acid backs up as far as the throat and larynx, the sleeper will wake up coughing and choking. If the acid only backs up as far as the esophagus the symptom is usually experienced as heartburn. Most people refer to GERD as heartburn, although you can have it without heartburn. Sometimes GERD can cause serious complications including inflammation of the esophagus from stomach acid that causes bleeding or ulcers. In a relatively small number of patients, GERD has been reported to result in a condition called Barrett's esophagus, which over time can lead to cancer. Also, studies have shown that asthma, chronic cough, and pulmonary fibrosis may be aggravated or even caused by GERD.

GERD is common and may be frequently overlooked in children. It can cause repeated vomiting, coughing, and other respiratory problems. Talk to your child's doctor if the problem occurs regularly and causes discomfort.

No one knows why people get GERD but factors that may contribute to it include:

- age
- diet
- alcohol use
- obesity
- pregnancy
- smoking

Also, certain foods can be associated with reflux events, including:

- citrus fruits
- chocolate
- drinks with caffeine
- fatty and fried foods
- garlic and onions
- mint flavorings
- spicy foods
- tomato-based foods, like spaghetti sauce, chili, and pizza

GERD affects people of all ages, ethnicities and cultures and tends to run in families.

SYMPTOMS:

The most frequently reported symptoms of GERD are:

- Heartburn
- Acid regurgitation
- Inflammation of the gums
- Erosion of the enamel of the teeth
- Bad breath
- Belching
- Chronic sore throat

Some patients with GERD experience no symptoms at all. Because of the wide range of symptoms associated with GERD and the need to distinguish it from heart-related problems, the number of medical visits and tests needed to diagnose or rule out the disease tends to be quite high.

TREATMENT:

GERD is a recurrent and chronic disease that does not resolve itself. If you are diagnosed with GERD, there are several methods of treatment which your doctor will discuss with you including behavioral modifications, medications, surgery, or a combination of methods. Over-the-counter medications may provide temporary relief but will not prevent symptoms from recurring.

The lifestyle changes you can make to minimize GERD include avoiding fats, onions, chocolate and alcohol. Losing weight may also help alleviate GERD symptoms.

Because of the association between GERD and sleep apnea, people with nighttime GERD symptoms should be screening for sleep apnea.

COPING:

These lifestyle modifications should help minimize reflux:

- Avoid lying down after a large meal
- Eat smaller meals and maintain an upright, relaxed posture
- Avoid fats, onions, chocolate and alcohol
- Avoid potassium supplements
- Always swallow medication in the upright position and wash it down with lots of water

Nighttime Heartburn Keeping You Up?

GERD May Be an Important Word for You to Know

Sixty-eight-year old John "Jack" Easterly has been suffering from gastroesophageal reflux disease (GERD) nearly all of his life. It started gradually, but slowly the pressure in his abdomen and the painful reflux of acid in his throat and mouth became so disturbing he sought the help of his doctor.

Several nights each week, beginning in his 20s, he would awaken, try to prop himself up in bed and sometimes get up, take an antacid and pace his bedroom until his symptoms subsided. "I didn't know there was anything wrong. I thought this is just the way it is because my dad had similar problems," says the Oklahoma City resident. "I remember feeling very sleepy and I had difficulty driving home from work. I was afraid of falling asleep behind the wheel."

Easterly is not alone. GERD affects people of every socioeconomic class, ethnic group and age, however more than 50% are males and females between the ages of 45–64. According to the federal Department of Health and Human Services, about seven million people in the US suffer from GERD.

Heartburn is the most common sign. According to the 2001 NSF *Sleep in America* poll, 62% of respondents reported experiencing insomnia due to nighttime heartburn.

Other symptoms include belching, difficulty or pain when swallowing, waterbrash (sudden excess of saliva), dysphagia (the sensation of food sticking in the esophagus), chronic sore throat, laryngitis, inflammation of the gums, erosion of teeth enamel, chronic throat irritation, hoarseness in the morning, a sour taste, and bad breath.

If left untreated, nighttime GERD can lead to a more serious problem known as Barrett's Esophagus, a potentially pre-cancerous changing of cells in the lining of the esophagus. The number of people who develop Barrett's Esophagus is relatively small: approximately 10% of patients who have GERD will develop the condition and only about one percent of those will develop esophageal cancer, according to the International Foundation for Functional Gastrointestinal Disorders.

In addition to Barrett's Esophagus, insomnia due to untreated nighttime GERD can also lead to excessive daytime sleepiness, which in turn can cause symptoms of depression, irritability, learning and memory difficulties, and falling asleep in situations demanding alertness, such as driving. People who reported often being sleepy during the day were more likely to describe themselves as dissatisfied with life (21% vs. 7%) and angry (12% vs. 4%) compared to those who were rarely or never sleepy during the day, according to the 2002 NSF *Sleep in America* poll.

While there is no cure for chronic GERD, it can be treated with simple lifestyle changes and medication. "If you're eating a large, heavy meal in the evening, it's best not to go to bed for at least two to three hours to avoid experiencing GERD," says William Orr, PhD, president and CEO of Lynn Health Science Institute in Oklahoma City and a NSF director. "People who experience heartburn once per week or more should consult a physician."

"I think people should seek help because it's a controllable situation," adds Easterly, who has been taking medication and monitoring his food intake since his 30s.

Gastroesophageal Reflux Disease (GERD)

William C. Orr, PhD

What is Gastroesophageal Reflux Disease (GERD)?

GERD is most commonly referred to as heartburn, or even acid reflux disease. It can be described as the back flow of stomach contents, including acid, into the esophagus (swallowing tube), resulting in a burning sensation.

How common is GERD?

GERD is extremely common. In fact, surveys indicate that about 44% of Americans experience heartburn once a month, and five percent report having heartburn several days a week. Even more people, about 65%, indicate that they have heartburn both day and night and report that their heartburn is worse at night and disrupts their sleep.

How does GERD affect sleep?

Of heartburn sufferers, a large majority experiences it at night. Our research indicates that nighttime GERD is a significant contributor to sleep problems. We've discovered that acid contact with the esophagus at night can prevent or delay the onset of sleep. Moreover, once asleep, the sleep is fragmented.

What is the nighttime GERD cancer connection?

Researchers have found that people who report nighttime heartburn at least once a week are at high risk of developing esophageal cancer. My studies have shown that nighttime acid reflux is a much more serious form of the disease, with more dire consequences. But, it's important to know that esophageal cancer is rare.

How is GERD treated?

GERD can be treated with both simple lifestyle changes and medication. Lifestyle changes include avoiding certain foods, such as tomato products, grapefruit, and high fat foods in general. Also, try to maintain a regular meal schedule, eat your meals at the same time each day. To avoid nighttime GERD, people can also sleep with the head of the bed slightly elevated.

There are also a variety of over-the-counter medications that people can try. There are antacids which offer relief by neutralizing acid and H2 Blockers which reduce acid.

When should someone see his or her doctor?

Individuals who have heartburn, which disrupts sleep once a week or more should consult their physician.

About GERD

The most frequent symptoms of GERD are so common that they may not be associated with a disease. Self-diagnosis can lead to mistreatment. Consultation with a physician is essential to proper diagnosis and treatment of GERD.

Gastroesophageal reflux disease, or GERD, affects at least an estimated 5% to 7% of the global population—men, women, and children. (Prevalence based on once per day heartburn.) Heartburn and/or acid regurgitation experienced weekly has been found to occur in 19.8% of individuals.(1)

Although common, GERD often is unrecognized—its symptoms misunderstood. This is unfortunate because GERD is generally a treatable disease. Serious complications can result if it is not treated properly.

Persistent heartburn is the most frequent—but not the only—symptom of GERD. (The disease may be present even without apparent symptoms.) Heartburn is so common that it often is not associated with a serious disease, like GERD. All too often, GERD is either self- treated or mistreated.

GERD is a chronic disease. Treatment usually must be maintained on a long-term basis, even after symptoms have been brought under control. Issues of daily living, and compliance with long-term use of medication need to be addressed as well. This can be accomplished through follow-up, support, and education.

Various methods to effectively treat GERD range from lifestyle measures to the use of medication or surgical procedures. It is essential for individuals who suffer persistent heartburn or other chronic and recurrent symptoms of GERD to seek an accurate diagnosis, to work with their physician, and to receive the most effective treatment available.

GERD POLL DATA:

GERD is the 3rd most common gastrointestinal disorder in the US and one of the leading causes of disturbed sleep among people between the ages of 45 and 64, according to the 2002 NSF *Sleep in America* poll.

GERD Examination

Select the *best* answer to each of the following items. Mark your responses on the Answer form.

1. Physiologically, NREM sleep is characterized by general slowing of autonomic function, with diminution of _____.

- a. heart rate
- b. blood pressure
- c. metabolic rate
- d. All the above

2. GER occurs less commonly during the sleeping interval, and is generally associated with a prolongation of acid clearance.

- a. True
- b. False

3. It is well established that GER is a common postprandial event; in fact, it is a normal physiological response to gastric distension that induces a transient relaxation of the lower esophageal sphincter.

- a. True
- b. False

4. The occurrence of REM sleep is controlled and regulated by specific brainstem nuclei that include the locus ceruleus and several nuclei located in the _____.

- a. Cerebellum
- b. Pons
- c. Pontine tegmentum
- d. None of the above

5. The mechanisms that normally control and regulate blood oxygen, carbon dioxide, and pH are essentially suspended during REM sleep. Furthermore, a complete skeletal-muscle paralysis exists during REM sleep and is generally thought to preclude physically acting out a dream. Thus, the physiological changes associated with sleep may influence nocturnal GER and esophageal acid clearance.

- a. True
- b. False

6. Short, rapidly cleared episodes of GER would appear to be relatively benign, while more prolonged episodes of GER are associated with greater risk of mucosal damage.

- a. True
- b. False

7. Nighttime GER can lead to the development of _____. These complications appear to be related primarily to the presence of significant supine acid-contact time during sleep.

- a. esophagitis
- b. exacerbation of asthma symptoms
- c. chronic cough
- d. All of the above

8. Studies provide considerable evidence that the sequelae of GER appear to be more severe in patients with nighttime symptoms. Patients with nighttime symptoms have a substantially diminished quality of life compared to individuals without nighttime symptoms.

- a. True
- b. False

9. GER, especially at night, has been implicated in the etiology of a variety of aerodigestive symptoms such as _____.

- a. wheezing
- b. chronic cough
- c. hoarseness
- d. All of the above

10. Nighttime GER symptoms not only appear to be more bothersome to patients, but are more difficult to control than daytime symptoms. While most patients with nighttime GER took medication for their problem, _____% had continuing symptoms in one study.

- a. 10
- b. 30
- c. 30
- d. 45

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