

Case Reports is a regularly featured column meant to highlight the clinical applications of alternative or integrative therapies as they are implemented in patient care. Preference will be given to cases in which diagnosis, treatment, and outcomes are clearly defined.

IMPROVEMENT OF GASTROESOPHAGEAL REFLUX DISEASE AFTER INITIATION OF A LOW-CARBOHYDRATE DIET: FIVE BRIEF CASE REPORTS

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Hearthburn (pyrosis) and gastroesophageal reflux symptoms are common complaints encountered in outpatient medical clinics.¹ It is estimated that up to 40% of adults in the United States have occasional heartburn (approximately once a month) and up to 10% experience daily heartburn.^{2,3} In addition, these symptoms have a substantial effect on health-related quality of life (QOL); in some studies, QOL can be impaired as severely as with angina or heart failure.⁴ Medications used to treat these symptoms have been among the most frequently prescribed medications in the United States in recent years. In fact, 2 medications commonly used for gastroesophageal reflux disease (GERD) rank among the top 5 medications of 1999 in terms of dollars spent.⁵

Heartburn is defined as a burning sensation that occurs in the substernal area, whereas gastroesophageal reflux is the "regurgitation of stomach contents into the esophagus, possibly into the pharynx."^{6(p1520)} The combination of these 2 symp-

toms is specific for GERD, especially if symptoms occur after meals, are aggravated by recumbency or bending at the waist, or are relieved by antacids.^{7,8} The pain encountered with heartburn is the result of prolonged contact of the esophageal mucosa with refluxed acid or other gastric contents.⁹ The pathophysiologic alteration that results in GERD symptoms appears to be abnormal esophageal motility with retrograde movement of gastric contents due to an ineffective lower esophageal sphincter (LES). The most frequent abnormality is an increased frequency of transient relaxations of the LES.¹⁰

Importantly, untreated GERD can result in many severe sequelae such as bleeding, Barrett's esophagus, esophageal stricture, laryngitis, laryngeal cancer, chronic cough, recurrent pneumonitis, and asthma, among others.¹¹ For this reason, endoscopy is recommended for patients with chronic or recalcitrant GERD symptoms or warning symptoms such as weight loss, dysphagia, early satiety, vomiting, or gastrointestinal bleeding.^{8,9} However, in most cases further evaluation is not warranted. In fact, recent practice guidelines suggest that it is appropriate to treat patients for GERD based on history alone.⁸ Moreover, the guidelines state that a diagnosis of GERD is likely in patients with classic symptoms who respond to therapy.

STANDARD TREATMENT FOR GERD

Initial therapy consists of lifestyle modifications because GERD symptoms are commonly exacerbated by certain factors. These modifications include removing certain foods from the diet. Acidic foods, such as tomato sauces, are thought to cause dyspepsia by increasing the acidity of the stomach. Some foods or ingested substances (eg, fatty foods, caffeine, coffee, chocolate, peppermint oil, alcohol), as well as cigarette smoking, can precipitate gastroesophageal reflux by relaxing the LES.^{10,11}

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Medications also can decrease LES tone (eg, β -adrenergic agents, calcium channel blockers, estrogen, progesterone, diazepam, barbiturates).¹² Foods of high osmolality, such as citrus juices, have been shown to exacerbate symptoms of GERD for unknown reasons, though delayed gastric emptying is suspected.^{13,14}

Other lifestyle recommendations include raising the head of the bed while sleeping, avoiding recumbency after meals, and losing weight in overweight individuals. If symptoms persist despite these interventions, medications such as antacids, H₂-blockers, proton pump inhibitors, and motility agents are commonly used to reduce the exposure of esophageal mucosa to stomach acid.

THE ATKINS' LOW-CARBOHYDRATE DIET

Low-carbohydrate diets for weight loss have gained popularity with the lay public despite the concerns of nutrition authorities and a lack of research demonstrating efficacy and safety. The proportion of daily calories from protein and fat in this type of diet are higher than standard recommendations. For this reason, many authorities have concerns about the safety of low-carbohydrate diets, especially in individuals with elevated serum cholesterol levels, cardiac disease, vascular disease, or renal disease.

The individuals in these case reports followed the Atkins' Diet, which initially restricts carbohydrate intake to as low as 20 g per day.¹⁵ This level of carbohydrate restriction is usually sufficient to induce ketone body formation, which can be detected by urinary dipstick.

In the initial, most restrictive phase, dieters ingest meals consisting of meat, poultry, seafood, cheeses, or eggs along with a salad or a small amount of low-carbohydrate vegetables. Protein and fat intake are unrestricted. Dieters are allowed to eat these foods until satiated, regardless of caloric content, as long as carbohydrate intake remains low. The diet restricts intake of foods that contain a significant proportion of calories from carbohydrate such as breads, pastas, potatoes and other starchy vegetables, cereals and grains, fruits and fruit juices, desserts, and sodas.

After weight loss has begun, the diet allows the slow addition of more vegetables, nuts, and fruits of low-carbohydrate content, as long as weight loss continues. In this way, carbohydrate intake can be increased to up to 90 g per day as the dieters approach their goal weight.

METHODS

In these case reports, we describe the findings of 5 individuals who noted prompt and complete relief of heartburn and reflux symptoms after self-initiating a low-carbohydrate diet for weight loss. Some of these individuals were participants in a low-carbohydrate-diet interest group at the Durham, NC, Veterans' Affairs Medical Center; others were participants on an Internet Listserv for low-carbohydrate

diets. Information was gathered by interviews in person, by telephone, or over the Internet. We have protected the identities of these individuals by changing their initials.

Following the case descriptions, we discuss possible mechanisms by which the low-carbohydrate diet may have contributed to a reduction of GERD symptoms. In addition, we review the literature regarding the effects of particular foods in persons with these symptoms. We also elaborate on the limitations of these brief case reports, particularly in regard to intake of substances containing caffeine or fat or substances of high osmolality.

CASE REPORTS

Case 1

M. P. is a 44-year-old, white, female administrative assistant diagnosed with depression and taking venlafaxine and oral contraceptives. She has suffered from dyspepsia since childhood. Originally, she experienced abdominal bloating and excessive eructation after certain meals, but developed intermittent mid-epigastric burning with associated water brash for 1 year before starting a low-carbohydrate diet. Her symptoms worsened in the supine position, causing her to get up from bed, and after spicy foods, coffee, and chocolate. She used over-the-counter medications (calcium carbonate, aluminum/magnesium hydroxide, bismuth subsalicylate) up to 3 times a day with immediate relief, and used prescription H₂-receptor antagonists intermittently when symptoms were more severe. She did not use tobacco or drink alcohol, but reported drinking up to 4 cups of coffee per day before starting the diet. To further evaluate her symptoms, she underwent a barium swallow with normal results.

The day after she started the low-carbohydrate diet, M. P. noted complete resolution of her symptoms. After beginning the diet, she changed to decaffeinated, low-acid coffee and now has only 1 to 2 cups per week. Even this type of coffee will exacerbate her symptoms if she does not restrict her carbohydrates adequately. She admits to nonadherence to the diet on occasion and notes return of symptoms when she eats foods with high-carbohydrate and high-fat content (eg, chocolate candy, potato chips, pretzels, bread). Her symptoms nevertheless have improved and she has had no further need for medication.

Case 2

T. D. is a 36-year-old, black, female administrative assistant diagnosed with adult-onset diabetes mellitus, hypertension, and hyperlipidemia. She takes NPH (neutral protamine Hagedorn) insulin, hydrochlorothiazide, and lisinopril. For many years she experienced symptoms of globus sensation, nausea, and water brash. Symptoms were worse with supine position, sometimes waking her from sleep, after fried foods, and after foods with tomato or cheese sauces. These symptoms were relieved by calcium carbonate or nonprescription-strength famotidine up to 4 times per day. T. D. did not use tobacco or drink alcohol. She drank 3 to 4 cola drinks per day and ate chocolate occasionally,

but did not drink coffee. Four years before starting the low-carbohydrate diet, she underwent a barium swallow that showed a small, sliding hiatal hernia and minimal reflux with maneuvers.

Her symptoms disappeared within 1 day of starting the low-carbohydrate diet. She has not required any antacid for the duration of the diet (8 months) and was able to lie supine soon after eating without occurrence of symptoms. She now drinks diet sodas only occasionally and has eliminated chocolate since starting the diet.

Case 3

L. L. is a 51-year-old, white, male business executive with no significant past medical history. He uses no prescribed medications. He first experienced regular heartburn and reflux symptoms when he was between 30 and 40 years old. Symptoms began to occur daily when he was between 40 and 50 years old. He described his symptoms as midepigastic and substernal burning, excessive eructation, and reflux of gastric contents into his throat. Symptoms were more prominent after ingesting caffeinated coffee (5 to 6 cups per day), bagels, tomato sauces, chocolate, and cake. He also experienced hoarseness and cough after a large meal. He often awoke around 2 AM due to symptoms and experienced emesis or at least regurgitation. L. L. first treated himself with calcium carbonate or magnesium hydroxide/calcium carbonate, using up to 12 tablets per day and requiring at least 3 tablets at once to resolve severe episodes. He changed to H₂-receptor antagonists when they were made available over the counter, and used up to 5 tablets per day. He did not use tobacco and drank 2 to 3 glasses of wine 2 to 3 times per week. In addition to his coffee intake, he drank many caffeinated diet soda drinks each day. He never sought medical attention for his disorder.

L. L. noted complete relief of symptoms within 1 day of starting the low-carbohydrate diet. He has not experienced return of the symptoms and has not needed any medication in the 7 months since starting the diet. He has decreased alcohol intake only slightly while eliminating caffeinated beverages and chocolate from his diet.

Case 4

E. F. is a 59-year-old, retired, white male with no significant past medical history other than cholecystectomy in 1998. He takes no medications other than a daily multivitamin. For 5 years he had occasional episodes of midepigastic and substernal burning associated with regurgitation of acidic-tasting stomach contents, especially after ingesting tomato sauces or spicy foods. Symptoms occurred most frequently at night, awaking him from sleep, and improved after 1 to 2 doses of effervescent aspirin/sodium bicarbonate/citric acid. He also tried calcium carbonate and aluminum/magnesium hydroxide with moderate improvement of symptoms. By avoiding foods that triggered his symptoms, he reduced the frequency of episodes to 5 times per month. Each morning he drank 3 to 4 cups of half-decaffeinated, half-regular coffee, which did not

exacerbate his symptoms. He drank 1 glass of red wine per day and did not use tobacco.

E. F.'s symptoms improved during the first week of the low-carbohydrate diet and disappeared in the second week. He has had no recurrence of symptoms and has not taken antacids for 1 year since initiating the diet. During the first 2 months of the diet he drank only decaffeinated coffee, but returned to the previous amount of half-regular coffee without recurrence of his symptoms. His alcohol consumption has not changed.

Case 5

J. F. is a 55-year-old, retired, white female married to E. F. (case 4). She has a medical history of rheumatoid arthritis, carpal tunnel syndrome, and migraine headaches. She takes ibuprofen occasionally for her headaches, daily doses of vitamin C, and 3 nutritional supplements for rheumatoid arthritis (glucosamine sulfate, quercetin, and bromelain). For 4 to 5 years she suffered from frequent episodes of midepigastic burning with regurgitation of acidic-tasting fluid whenever she bent at the waist or reclined too soon after eating. Symptoms were worse after she ate tomato sauces on pastas or drank coffee. During the day she controlled her symptoms by remaining upright. When the acid reflux interrupted her sleep at night, she took effervescent aspirin/sodium bicarbonate/citric acid, averaging 1 to 2 doses per night. Due to her symptoms she drank regular coffee only once a week, but drank 1 to 2 cups of tea per morning and did not drink sodas. She did not use tobacco and rarely drank alcoholic beverages.

J. F. noted relief of her heartburn and reflux symptoms within the first 2 weeks of the low-carbohydrate diet. She has not used antacids for 1 year since she started the diet and has no symptoms if she bends at the waist or lies down soon after a meal. She notes no symptoms after ingesting tomato sauces as long as she keeps her daily carbohydrate intake low. She notices mild recurrence of her symptoms if she does not adhere to the diet for 3 or more days, especially after eating bread, fruit, tomatoes, sauerkraut, or vinegar dressings. She presently drinks regular coffee, sometimes up to 4 cups per day, and has not changed her daily nutritional supplement intake.

COMMENT

The individuals in these case reports experienced complete and nearly immediate resolution of GERD symptoms after initiating a low-carbohydrate diet. Except during periods of non-adherence by some individuals, an informal assessment revealed that they restricted carbohydrate intake to 20 g per day.

We have found only 1 abstract that examined the effect of a low-carbohydrate diet on dyspepsia.¹⁶ In the nonrandomized, controlled, crossover trial described in the abstract, 41 participants with severe dyspepsia were alternately assigned a low-carbohydrate diet or a "gastric diet" (presumably a low-fat, low-acid, bland diet with no caffeine or alcohol, but this was not defined). Participants remained on one diet for 3 months, then crossed over to the other diet for 3 months. Twenty-eight

(68%) of the participants had improvement of dyspepsia on the low-carbohydrate diet compared to the gastric diet, 11 (27%) noted no difference, and 2 (5%) had worse symptoms.

Several foods known to exacerbate gastroesophageal reflux are restricted by the low-carbohydrate diet. Acidic foods and foods of high osmolality, such as tomato sauces and fruit juices, respectively, have high-carbohydrate contents. Many alcoholic beverages also have high-carbohydrate contents, so dieters are restricted to light beers and distilled spirits (with low-carbohydrate mixers only). In addition to restricting carbohydrates, the diet recommends limiting caffeine. In addition, individuals presumably have a high fat intake on the diet, but this is not a requirement. Certainly the ratios of fat to carbohydrate and protein to carbohydrate increase.

Mechanisms of Relief

Several possible mechanisms can explain the symptomatic relief these 5 individuals experienced. Weight loss can alleviate gastroesophageal reflux, but the promptness of their symptomatic relief makes this an unlikely mechanism.

Reduction of caffeine or coffee intake also can improve heartburn. Three of the 5 individuals decreased their intake of caffeine or coffee, but 1 did not change consumption and 1 increased intake. These dietary changes confound the observations of the first 3 individuals.

Acidic foods and foods of high osmolality also might be confounders. If they followed the diet correctly, the individuals presumably restricted their intake of citrus juices and tomato sauces. However, their use of substances such as tobacco products and alcohol did not change after they initiated the diet. Therefore, these substances are unlikely to factor into their symptom relief.

Finally, elimination of possible food allergens must be considered. Allergy to cow's milk protein has been implicated as a cause of GERD in infants.¹⁷ However, the low-carbohydrate diet allows intake of heavy cream and cheese. Elimination diets (removing different food allergens) have been studied in patients with irritable bowel syndrome and inflammatory bowel disease.^{18,19} Other food allergens that cause GERD may exist, but they have not been reported in the literature.

Interestingly, 2 individuals (case 1 and case 5) noted recurrence of symptoms after reintroducing high-carbohydrate, nonacidic, nonfatty foods such as pretzels and bread. But J. F. (case 5) was able to enjoy foods (eg, tomato sauces, coffee) that previously exacerbated her symptoms as long she limited her overall daily carbohydrate intake.

What is striking also about these findings is that they do not confirm the common recommendation to restrict fat intake to prevent gastroesophageal reflux symptoms.^{10,20} Although we did not quantify daily fat intake in these patients, the individuals described their diets as high in fat. In studies of normal subjects, fat intake has been shown to reduce LES tone,²¹ increase the frequency of transient LES relaxations,^{22,23} and increase esophageal acid exposure.^{24,25} However, in studies of patients with GERD, increased esophageal acid exposure due to high fat intake has not been seen, and some

authors have questioned the common recommendation that GERD sufferers should restrict fat intake to alleviate symptoms.^{24,26}

SUMMARY

The 5 individuals described in these case reports experienced resolution of GERD symptoms after self-initiation of a low-carbohydrate diet. Their observations suggest that carbohydrate restriction may have contributed to their symptom relief. However, this conclusion is confounded by concurrent reduction of caffeine intake in 3 of the individuals and reduction of acidic and high-osmolal food intake in all of them. Observations from some of these individuals suggest that carbohydrates may be a precipitating factor for GERD symptoms and that other classic exacerbating foods such as coffee and fat may be less pertinent when a low-carbohydrate diet is followed. However, these conclusions are preliminary. These findings primarily suggest that prospective research should be performed on the effect of low-carbohydrate diets on GERD symptoms. Trials that control for all of the confounders mentioned above and that contain objective endpoints are needed to further investigate these issues.

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