

Celiac Disease and the Athlete

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Abstract:

With the diagnosis of celiac disease rising in the past decade and with increased public awareness, team physicians are faced with both managing and diagnosing athletes with celiac disease. Sports medicine physicians need to recognize that celiac disease can present with a number of different symptoms and, therefore, should consider celiac disease as part of their differential in evaluating athletes with prolonged unexplained illnesses. Sports medicine physicians must be familiar with the appropriate laboratory tests and diagnostic procedures used to establish the diagnosis of celiac disease. A multidisciplinary approach in helping the newly diagnosed athlete with celiac disease is important to the successful treatment of the disease. Athletes with celiac disease often have problems with iron absorption (leading to anemia) and/or vitamin D and calcium absorption (leading to osteoporosis and poor bone health). Even athletes with known and long-standing celiac disease need additional care and supervision in ensuring there is no disruption in their gluten-free diet, which can lead to a flare-up of symptoms or a decrease in performance.

Introduction

The diagnosis of celiac disease is becoming more and more prevalent in our society (1,2). As awareness of celiac disease increases, within both the medical community and the general public, the sports medicine team, led by the team physician and the other members of the interdisciplinary team (*i.e.*, athletic trainers, nutritionist), will be taking care of more and more athletes with this condition. The goals of this article are the following: 1) to review the basic pathophysiology of celiac disease, 2) to discuss the presentation and initial work-up for the athlete suspected of having celiac disease, 3) to discuss management of the athlete with newly diagnosed celiac disease, and 4) to discuss long-term management of the athlete with known and established celiac disease.

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Celiac Disease

Overview

Celiac disease is a hereditary autoimmune disorder causing malabsorption within the gastrointestinal tract. The body's immune system overreacts to gluten- or gliadin-containing foods. Gluten is a protein found in wheat, barley, and rye. When an individual with celiac disease ingests a gluten-containing substance, his or her immune system damages the small intestinal mucosa, which may cause villous atrophy (5). This reduces the colon's ability to absorb important nutrients.

In people with celiac disease, the immune system inflames the villi when it detects gluten, in order to protect the body. The inflammation of the villi leads to flattening, which significantly

impairs the body's ability to absorb nutrients. There may be total or subtotal villous atrophy, crypt hyperplasia, and lymphoplasmacellular infiltrate in the intestinal lamina propria. Even though celiac disease's primary effect is on the gastrointestinal tract, it actually is a multisystem disease as a result of this inability to absorb nutrients. Celiac disease also has been shown to have effects on the blood, bone, brain, nervous system, and skin (5,4).

To develop celiac disease, one must have a genetic predisposition and antigen exposure. It is believed that approximately 30% of the population carries the genetic markers for celiac disease. The genetic markers linked to celiac disease are human leukocyte antigen (HLA)-DQ2 and HLA-DQ8. These markers are found in 99.6% of people with celiac disease (1). However, only approximately 1% of the population has active celiac disease (13,10). Women are 2.5 times more likely to have celiac disease compared with men. Experts believe that there is some trigger that causes expression of the genetic markers and causes an individual to develop celiac disease (1,13,10).

Athlete Presentation and Initial Evaluation of Celiac Disease

Celiac disease can be diagnosed in individuals of any age. Adolescent and adult presentation of celiac disease is more insidious than in the pediatric population (4). Often, an athlete may have been experiencing symptoms for a prolonged

Table 1.
Signs and symptoms of celiac disease.

Symptoms	Percentage
Chronic diarrhea	50%–70%
Abdominal bloating	40%–60%
Malnutrition/failure to thrive	30%–60%
Fatigue/weakness	30%–60%
Vomiting	10%–40%
Anemia	10%–30%
Abdominal cramping	10%–20%
Abdominal pain	10%–20%
Myalgia	10%–20%
Arthralgia	10%–20%
Osteopenia/osteoporosis	10%–20%
Menstrual irregularities	10%–20%
Irritability	5%–20%
Constipation	5%–10%
Short stature	5%–10%
Dermatitis herpetiformis	5%–10%

period of time — months or even years — before celiac disease is diagnosed. One reason why it often can take a long time to make the diagnosis of celiac disease is the wide array of symptoms with which an individual can present. Table 1 shows this spectrum of symptoms.

As an athlete could present with any of these symptoms, a thorough examination and work-up is essential in making the diagnosis. Because of the signs and symptoms of celiac disease overlapping with many other common illnesses, it can be hard to diagnosis at first. This differential should include infectious mononucleosis, lactose intolerance, dyspepsia, irritable bowel disease, eating disorder, depression, diverticular disease, Crohn's disease, fibromyalgia, iron-deficiency anemia, hypo/hyperthyroidism, and food allergies. Celiac disease should be considered if symptoms continue in acute illnesses or during the work-up in chronic illnesses.

In reviewing the literature, there are two case reports of Division I collegiate athletes being newly diagnosed with celiac disease (3,9). Their stories are typical: both had symptoms that first were considered to be consistent with another illness, but with thorough questioning and further diagnostic tests, the correct diagnosis was discovered. Both athletes responded to proper treatment.

A detailed history should be taken, with special attention to family history. The prevalence of celiac disease is 4% to 12% in individuals with first-degree relatives who have celiac disease (4). A family history also should include questions regarding the stature of parents and siblings (short stature is associated with celiac disease), a family history of gastrointestinal problems, type I diabetes, anemia, hypothyroidism, or osteopenia. For example, a female athlete had a height of 162.5 cm, whereas her mother's

height was 172.2 cm, and her sister's height was 175.3 cm (3). Questions about the athlete's past medical history should include fatigue, energy level, exercise tolerance, and gastrointestinal symptoms, such as diarrhea, bloating, and abdominal pain. Athletes should be asked about a history of stress fractures, anemia, and nutritional questions about gluten-containing foods. After a thorough history is obtained, a detailed physical exam should be conducted.

Laboratory Tests in Diagnosis of Celiac Disease

In working up the diagnosis of celiac disease in an athlete with symptoms, more common diseases should be tested for. Table 2 contains the recommended laboratory tests.

If a diagnosis of celiac disease is believed, the initial serologic test is a tissue transglutaminase (tTG) antibody level. The tTG is an enzyme that is found in every tissue in the body (5,13), and it acts to join proteins together, serving to heal wounds and remove damaged tissue. In people with celiac disease, tTG converts gliadin into a form that activates specific immune cells and triggers the inflammatory response that leads to flattening and atrophy of the villi in the small intestine. The IgA antiendomysial antibody (EMA) is another serologic test that can be used to diagnose celiac disease. Recently, tTG antibody testing has been shown to be more sensitive and specific in diagnosing celiac disease (4). A systematic review of tTG and EMA sensitivity and specificity showed that pooled estimates for EMA were 0.90 (95% confidence interval [CI], 0.80 to 0.95) for sensitivity and 0.99 (95% CI, 0.98 to 1.00) for specificity, positive likelihood ratio (LR) of 171 and negative LR of 0.11. Pooled estimates for tTG antibodies were 0.89 (95% CI, 0.82 to 0.94) and 0.98 (95% CI, 0.95 to 0.99) sensitivity and specificity, respectively, with positive LR of 37.7 and negative LR of 0.11 (15). The test for diamidated gliadin peptides shows good specificity, but further work is needed to determine its role in diagnosing celiac disease (15). However, the gold standard for confirming the suspected diagnosis of celiac disease is a biopsy of the small intestine demonstrating blunted villous (8). To accurately diagnose a patient with celiac disease Catassi recommends that four of

Table 2.
Laboratory tests in differentiating celiac disease.

Test	Other Possible Diagnoses
Basic metabolic panel	Electrolyte abnormalities from eating disorder
CBC	Iron-deficiency anemia
Mono spot	Infectious mononucleosis
TSH	Thyroid disease
Lyme titer	Lyme disease
Vitamin D level	Vitamin D deficiency
Allergy testing	Food allergies
Urine hCG test	Pregnancy
Urine tox screen	Illicit drug use

CBC = complete blood count; TSH = thyroid-stimulating hormone; HCG = human chorionic gonadotropin.

the five following features are present: typical symptoms of celiac disease, positivity of serum celiac disease IgA class autoantibodies at high titer (tTG or EMA), HLA-DQ2 or DQ8 genotypes, celiac enteropathy at the small intestinal biopsy, and response to a gluten-free diet (GFD).

Management of the Athlete Newly Diagnosed with Celiac Disease

For an athlete, a new diagnosis of celiac disease represents a total lifestyle change. A multidisciplinary approach is the best way to address all the issues facing a newly diagnosed athlete. Because completely changing one's diet while trying to perform athletically at the highest level can be extremely stressful, it is suggested that athletes also meet with a sports psychologist.

Eating a strict GFD is the only known treatment of celiac disease; therefore, the athlete should meet with a nutritionist. Eliminating all sources of wheat, rye, and barley means the athlete must find alternative healthy sources of carbohydrates. The recommended intake of carbohydrates is 6 to 10 g·kg⁻¹ body weight. Beans, rice, corn meal, corn flour, nuts, potatoes, tapioca, and quinoa are excellent sources of carbohydrates for the athlete with celiac disease, along with fresh fruits and vegetables.

Educating the athlete, the athletic training staff, coaches, and the athlete's teammates about celiac disease and what a GFD entails is an important piece in normalizing the athlete's new life. For the coaching staff, where a team eats when traveling for away games will need to include restaurants that have gluten-free choices for the athlete in order to achieve his or her proper nutrition. The athlete's teammates should be educated to understand how easy it is to cross-contaminate gluten-free choices with gluten-containing foods. One such example is spreading gluten-free peanut butter on a bagel (gluten-containing) with a knife and then sticking the used knife back into the gluten-free peanut butter, thereby cross-contaminating the peanut butter. Since teammates often share snacks, this concept of cross-contamination needs to be made clear. Because many athletic training rooms keep various types of meal replacement bars, energy drinks, or other nutritional aids on hand, the athletic training staff needs to check on the gluten-free status of these products. We have found good alternatives to the standard gluten-containing products. Long-term tTG laboratory follow-up in an athlete newly diagnosed with celiac disease is important, especially to make sure that the levels normalize within the first year.

Because iron-deficiency anemia has been reported in the range of 10% to 70% of people with newly diagnosed celiac disease, the athlete should be evaluated for iron-deficiency anemia (2,6). Iron-deficiency anemia is prevalent in people with celiac disease because of the difficulty in absorbing iron in the small intestines. In athletes with newly diagnosed celiac disease, it can take 2 to 18 months to correct the anemia. Athletes should be advised, with the help of a nutritionist, to focus on a GFD high in iron-rich foods. Also, the athlete should be supplementing his or her diet with a gluten-free multivitamin. Iron levels should be checked 6 months after starting the GFD.

Because celiac disease impairs the absorption of nutrients, vitamin D deficiency and calcium malabsorption

are common (16). With 10% to 20% of patients diagnosed with celiac disease having osteopenia or osteoporosis at the time of diagnosis, assessment of an athlete's bone mineral density (BMD) is imperative (7). While the current recommendation of the American Gastroenterology Association is that dual energy x-ray absorptiometry (DEXA) scans are unnecessary in children with newly diagnosed uncomplicated celiac disease (11), DEXA scans are recommended in adults (2). In athletes, especially women, a DEXA scan should be performed to assess BMD. Taking a gluten-free calcium and vitamin D supplement is recommended. Many newly diagnosed patients with celiac disease also are temporarily lactose intolerant, so nondairy calcium sources should be added to the athlete's diet. Foods such as fortified orange juice, broccoli, spinach, and fish can serve this purpose, as they are high in calcium. Grains such as amaranth, quinoa, and teff also are high in calcium (2). Other nutrients, including vitamin B12, folic acid, zinc, and copper, may be deficient. There is no consensus on checking these levels.

The Athlete with Long-Standing Celiac Disease

For the athlete who has been diagnosed with celiac disease for 1 yr or longer, strict adherence to the GFD is the most important factor in long-term treatment and control. Approximately 60% of patients with celiac disease follow a GFD (14). While the athlete with long-standing celiac disease may be following the GFD, may have his or her tTG levels at a normal level, and may have long moved past the social and emotional challenges faced by someone with newly diagnosed celiac disease, he or she still faces daily challenges in managing the disease. Travel and team meals are recurrent issues that require constant vigilance and attention. Planning ahead so gluten-free options are available is a must in order for the athlete with celiac disease to maintain his or her health and peak athletic performance. Athletes with celiac disease have to be much more intelligent about their food choices in order to ensure they are meeting their protein, healthy fat, and carbohydrate goals. Athletes with celiac disease may have a difficult time meeting their caloric needs in order to provide sufficient energy to ensure peak athletic performance (2). Athletes with celiac disease in the collegiate setting will have to familiarize and educate themselves as to the gluten-free choices available in the dining halls and food courts on their college campus. Nutrition around workouts with respect to protein shakes and pre- and post-workout drinks needs to be researched to ensure their gluten-free status (12). The athlete with celiac disease needs to know that exposure to gluten can precipitate an exacerbation of his or her disease that also may cause a decrease in athletic performance.

Conclusion

In conclusion, with the diagnosis of celiac disease rising in the past decade and with an increase in public awareness, team physicians are faced with both managing and diagnosing athletes with celiac disease. Sports medicine physicians need to recognize that celiac disease can present with a number of different symptoms and, therefore, should consider celiac disease part of their differential in evaluating athletes with prolonged unexplained illnesses. Sports

medicine physicians must be familiar with the appropriate laboratory tests and diagnostic procedures used to establish diagnosis of celiac disease. The sports medicine physician must coordinate a multidisciplinary approach in helping the newly diagnosed athlete with celiac disease. Also, even athletes with known and long-standing celiac disease will need additional care and supervision in ensuring that there is no disruption in their GFD, which can lead to a flare-up of symptoms or a decrease in performance.

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