



The Mystery of Celiac Disease and Type 1 Diabetes

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Objectives

- Discuss the pathophysiology of celiac disease, presenting symptoms and diagnostic tests
- Identify three conditions associated with celiac disease
- Describe the nutritional plan for celiac disease
- List four hidden sources of gluten
- Recognize two resources for healthcare professionals and patients

Definitions

Celiac disease (also known as sprue or gluten intolerance)

- Autoimmune disease
- Occurs in genetically susceptible persons
- Intolerance to gluten

Type 1 diabetes

- Autoimmune disease
- Autoimmune destruction of the pancreatic beta cells with resulting absolute insulin deficiency

Characteristics of Type 1 Diabetes

- Usually occurs before age 30
- Requires exogenous insulin to prevent ketoacidosis and sustain life
- Coma and death can result from a delayed diagnosis and/or treatment
- Symptoms may include significant weight loss, polyuria and polydipsia

Characteristics of Celiac Disease

- Environmental trigger (gluten)
- Autoantigen (tissue transglutaminase) component
- Gluten intolerance, not a food allergy

Pathophysiology of Celiac Disease

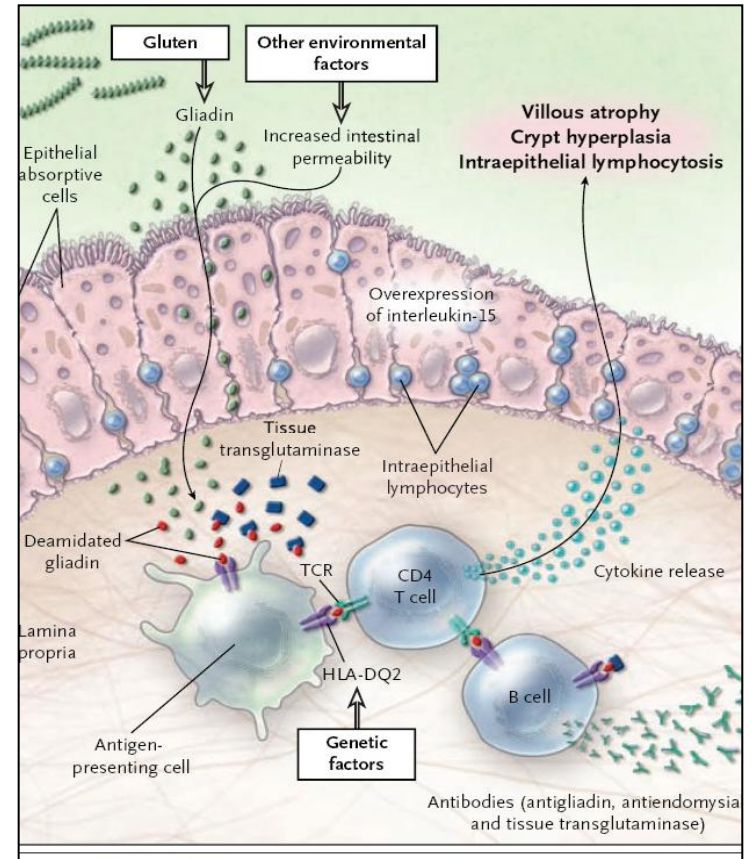
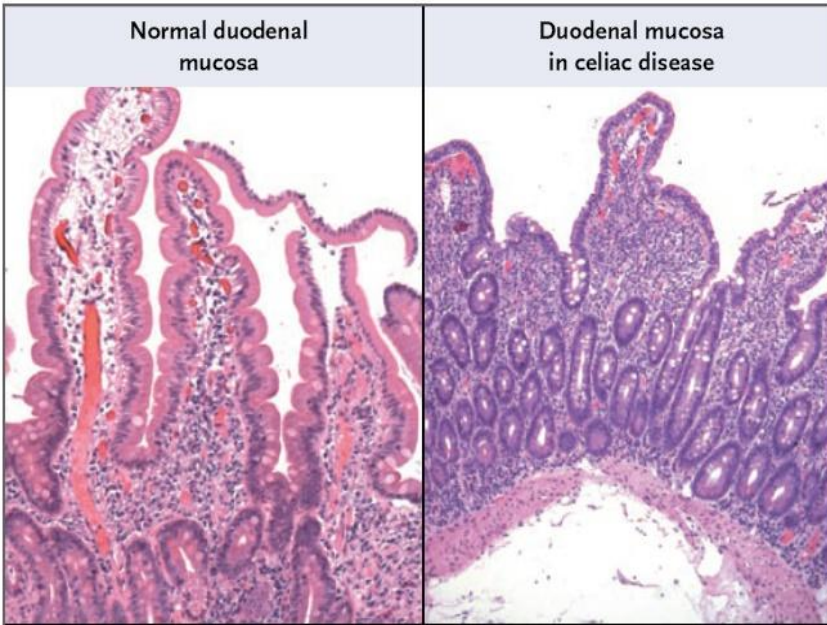


Illustration used with permission of Dr. Peter Green.
 From Green PHR, Cellier C. Celiac disease. *N Engl J Med.* 2007; 357:1731-43.

Pathophysiology of Celiac Disease

- Villi resemble deep pile of a plush carpet on a microscopic scale
- Damages the villi causing a “leaky gut”
- Exposure to certain grain proteins through a “leaky gut” turns on the autoimmune trigger for the development of celiac disease in genetically susceptible people
- Without the villi, the inner surface of the small intestine becomes more like a tile floor
- Resulting in an inability to digest and absorb nutrients and ultimately a loss of nutrients in the stool

The Celiac Iceberg

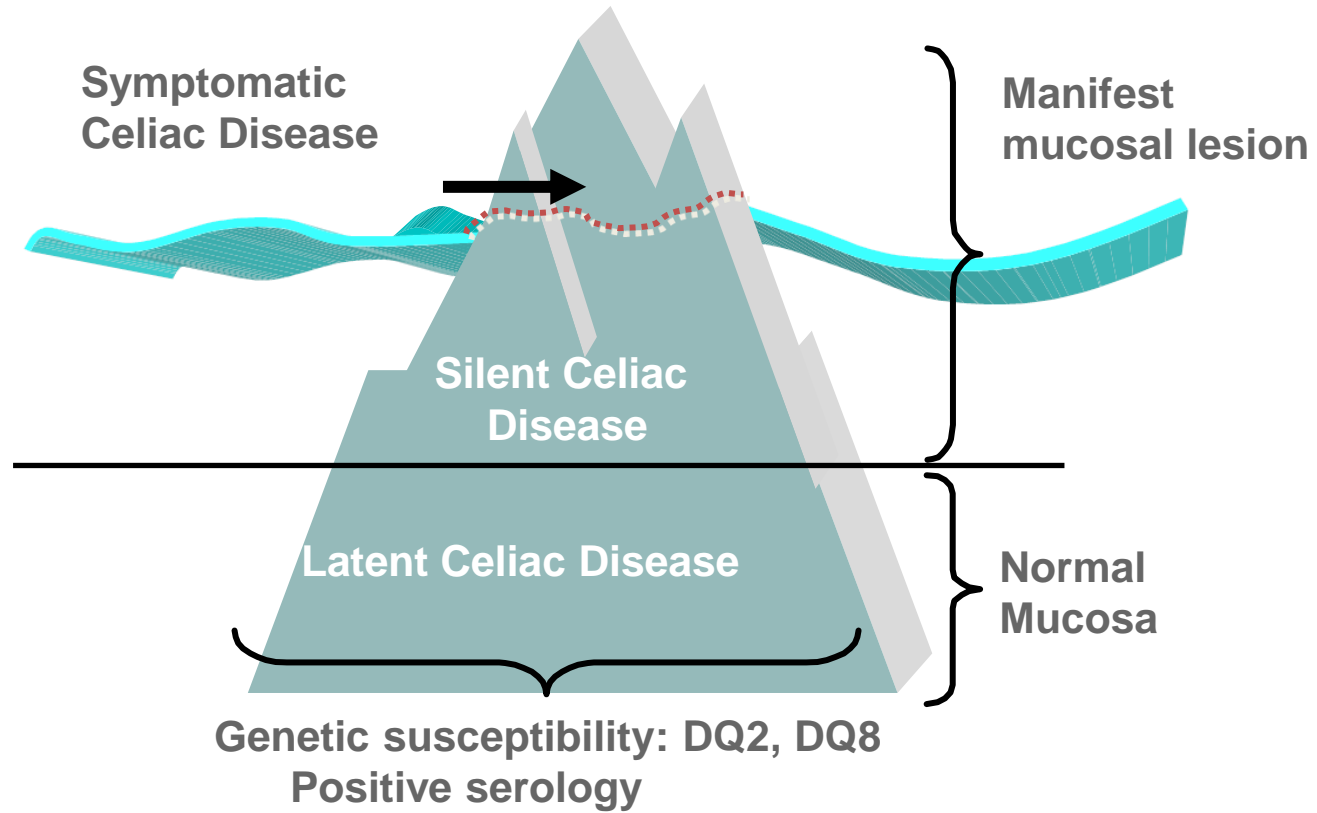


Illustration courtesy of Dr. Alessio Fasano, Center for Celiac Research, University of Maryland School of Medicine. Used with permission.

Prevalence of Celiac Disease

- **One out of every 100 people in the United States**
 - 1% of the population
 - 97% of these are undiagnosed
- **Celiac disease affects 3 million Americans**
- **2-3 times more common in women than men**

Environmental Impact on Celiac Disease

- **Breastfeeding**
 - Potential protective effect upon development of celiac disease
- **Increased risk of celiac disease if gluten introduced either <4 months or >7 months of age**
- **Overlap of gluten introduction and breastfeeding may be key**

Gastrointestinal Symptoms

- **Chronic or recurrent diarrhea**
- **Abdominal distension**
- **Anorexia**
- **Abdominal pain**
- **Vomiting**
- **Constipation**

Non-Gastrointestinal Presentations

- Dermatitis herpetiformis
- Dental enamel hypoplasia
- Osteopenia or osteoporosis
- Short stature
- Delayed puberty
- Infertility
- Iron-deficient anemia resistant to oral iron replacement
- Chronic fatigue
- Inability to concentrate
- Irritability
- Failure to thrive/weight loss
- Recognized during endoscopy for other complaint

Associated Autoimmune Diseases

- Affect 3% of general population, but 30% of those with celiac disease
- Celiac disease is the only autoimmune disorder in which the trigger is known
- Believed that celiac disease develops first, predisposing person to other autoimmune diseases

Celiac Disease and Autoimmunity

- **Conflicting evidence whether increased duration of gluten exposure increases risk of Type 1 diabetes and other autoimmune disorders**
- **Further investigation is warranted**
 - Impact of early diagnosis and gluten-free diet treatment on the occurrence of other autoimmune disorders
 - Common genetic involvement between celiac disease and endocrine/autoimmune disorders

Associated Immune Disorders

- **Dermatitis herpetiformis**
- **Type 1 diabetes**
- **Thyroid disease**
 - Hypertthyroidism
 - Hypothyroidism
- **Liver disease**
- **Systemic lupus erythematosus**
- **Sjögren's syndrome**
- **Addison's disease**
- **Cardiomyopathy**
- **Alopecia areata**
- **Rheumatoid arthritis**
- **Down's Syndrome**

Type 1 Diabetes and Celiac Disease

- 7-12% of those with Type 1 diabetes also have celiac disease
- **Common presentation:**
 - Unpredictable blood glucose (BG)
 - Hypoglycemia
 - Deterioration of BG control
 - Gastrointestinal symptoms may mimic or be confused with gastroparesis
- **Patients may be asymptomatic**

See J, Murray RA, Gluten-free diet: The medical and nutrition management of celiac disease. *Nutr Clin Pract.* 2006; 21:1-15.
Banion C, Valentine V. Type 1 diabetes throughout the life span. In: Mensing C, ed. *The Art and Science of Diabetes Self-Management Education.* Chicago, IL: American Association of Diabetes Educators; 2006: 207.

Complications of Celiac Disease

- **Intestinal carcinoma**
- **Lymphoma**
- **Refractory celiac disease**
- **Osteoporosis**

Diagnostic Testing for Celiac Disease

- **Serology**
 - Antiendomysial antibodies (EMA)
 - Anti-tissue transglutaminase (tTG)
 - Sensitivity of EMA and tTG testing is >90%
- **Small bowel biopsy to verify the diagnosis**

Duodenal Biopsy

- **Gold standard for diagnosing celiac disease**
- **Should be performed if clinical suspicion is high regardless of serology**
- **Multiple specimens should be obtained due to patchy nature of disease**
- **Diagnosis confirmed when favorable response to gluten-free diet**



Additional Screening Tests with Celiac Disease

- **Assess**
 - Electrolytes, protein, and calcium levels
 - Kidney and liver function
 - Nutrient deficiencies (iron, folate, fat soluble vitamins, calcium)
 - Inflammation (erythrocyte sedimentation rate {ESR} and C-reactive protein {CRP})
- **Screening for osteoporosis**
- **Monitor growth and development in children**

Treatment for Celiac Disease

- **The ONLY treatment is a gluten-free diet**
- **Strict, lifelong diet**
- **Total avoidance of:**
 - Wheat
 - Rye
 - Barley

Green PHR, Cellier C. Celiac disease. *N Engl J Med.* 2007; 357:1731-43.

Green P, Jones R. *Celiac Disease: A Hidden Epidemic.* New York: HarperCollins; 2010:93. 194 .

Type 1 Diabetes and Celiac Disease

- **“Double diet” is challenging and costly**
 - Label reading for gluten and carbohydrate
 - Many gluten-free foods are higher in carbohydrates than regular items
- **Initiation of gluten-free diet reduces hypoglycemia**
- **Must treat hypoglycemia with gluten-free foods**

Green P, Jones R. *Celiac Disease: A Hidden Epidemic*. New York: HarperCollins; 2010.137.

Schwarzenberg SJ, Brunzell C. Type 1 diabetes and celiac disease: Overview and medical nutrition therapy. *Diabetes Spectrum*. 2002; 2002:197-201.

What is Gluten?

- **Gluten is a cohesive elastic protein commonly found in products that contain cereal grains**
- **Toxic proteins in celiac disease**
 - Gliadin (wheat)
 - Secalin (rye)
 - Hordein (barley)

Common Sources of Gluten

- Bread
- Pastries, cookies and pies
- Salad croutons
- Pizza crust
- Cereal
- Pasta
- Beer
- Cross-contaminated oats

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Potential Sources of Gluten

- Candy
- Soy sauce
- Canned soups, sauces
- Communion wafers
- Cured pork wafers
- Drink mixes
- Imitation meat/ seafood
- Self-basting poultry
- “Seasonings” & “flavorings”



Potential Sources of Gluten

- Chewing gum
- Lipstick and lip balm
- Shampoos, hair gels
- Skin lotions and creams
- Bubble bath and soaps
- Home cleansers and cleaning products
- Medications
 - Prescription, over the counter, herbal
 - Vitamins and minerals

Flours to Avoid Containing Proteins from Wheat, Rye & Barley

- Bulgur
- Couscous
- Graham flour
- Kamut
- Semolina (durham)
- Spelt
- Triticale
- Wheat germ



Gluten-Free Grains

- **Compared to gluten containing grains, most gluten-free grains are:**
 - Higher in carbohydrate
 - Higher in fat
 - Lower in fiber than regular gluten containing foods
- **Glycemic response tends to be higher and faster**

Carbohydrate (CHO) Content of Flour

Flour	CHO grams per/cup
Wheat flour	95
Soy flour	33
Amaranth flour	130
Rice flour-white	126
Tapioca flour	128
Potato flour	134
Garbanzo flour	200
Corn starch	116
Quinoa	116
Sorghum	144

Gluten-Free Foods

- **Fruits**
- **Vegetables**
- **Milk**
- **Potatoes**
- **Corn**
- **Rice**
- ***Fresh* meat, fish, poultry, eggs**

Green P, Jones R. *Celiac Disease: A Hidden Epidemic*. New York: HarperCollins; 2010:24.

See J, Murray RA, Gluten-free diet: The medical and nutrition management of celiac disease. *Nutrition in Clinical Practice*. 2006; 21:1-15.

Gluten-Free Foods

- Butter, margarine, oil
- Tea, coffee, soda
- Plain popcorn
- Plain nuts
- Honey
- Ketchup, mustard (must have *distilled* vinegar)
- Distilled alcoholic beverages

Food Labels

- **Food Allergen Labeling and Consumer Protection Act**
- **Statement on food labels that identifies which, if any, of the eight main food allergens are contained in an item**
 - Milk, eggs, peanuts, tree nuts, fish, crustacean shellfish, soy and wheat
- **Not all “wheat-free” items are “gluten-free” however, all “gluten-free foods “are “wheat-free”**
- **Term “gluten-free” is being defined for voluntary use**

Barriers to Adherence to Gluten-Free Diet

- High cost
- Poor availability of gluten-free products
- Poor quality/taste
- Absence of symptoms from gluten ingestion
- Inadequate labeling of food/ drugs
- Inadequate dietary counseling
- Inadequate education from healthcare provider

Challenges of the Gluten-Free Diet

- **Inadequate medical or nutritional information and/or follow-up**
- **Lack of participation in a support group**
- **Eating away from home**
 - Restaurants, social occasions, professional situations, travel
- **Social, cultural or peer pressures**
- **Transition to adolescence**
- **Cross-contamination**
- **Food without labels**
 - Carbohydrate, gluten

Causes of Poor Response to Treatment

- **Most with celiac disease respond positively to gluten-free diet**
- **Multiple factors may contribute to poor response to diet such as incorrect diagnosis, other bowel disease, lactose intolerance or intolerance to other food item**
- **Further assessment of dietary adherence and verification of diagnosis are warranted**

Benefits of Insulin Pump Therapy in Celiac Disease

- **Extended/Combo bolus feature**
 - Bolus delivered over time
 - Precise dosing increments in a pump allow better match of insulin and carbohydrate
 - Symptoms of celiac disease often mimic gastroparesis by causing hypoglycemia after meals (poor absorption)
 - As gut heals, the duration can be decreased
- **Temporary basal**
 - Adjust basal rates based upon blood glucose (BG) readings

Helpful Hints

- Before testing for celiac disease, the patient **MUST** follow a regular diet--not gluten-free
- Take care to avoid accidental ingestion of gluten (cross-contamination, airborne)
- Gather resources--nutrition consult with a Registered Dietitian (RD) familiar with celiac disease, support group
- Read labels and ask questions, particularly when dining out

Summary

- **Celiac disease is associated with other autoimmune conditions, including Type 1 diabetes. This challenging disorder can be successfully managed with education, utilization of available technology and resources, and a measure of compassion and support.**
- **C**onsultation with a skilled dietitian
- **E**ducation about the disease
- **L**ifelong adherence to a gluten-free diet
- **I**dentification and treatment of nutritional deficiencies
- **A**ccess to an advocacy group
- **C**ontinuous, long term follow up

Resources

American Celiac Society
59 Crystal Avenue
West Orange, NJ 07052
Phone: (973) 325-8837
Email: amerceliacsoc@netscape.net

Celiac Disease Foundation
13251 Ventura Boulevard, #1
Studio City, CA 91604-1838
Phone: (818) 990-2354
Email: cdf@celiac.org
Internet: www.celiac.org

Celiac Sprue Association/USA Inc.
P.O. Box 31700
Omaha, NE 68131-0700
Phone: (402) 558-0600
• Internet: www.csacelics.org

National Center for Nutrition and Dietetics
American Dietetic Association
216 West Jackson Boulevard, suite 800
Chicago, IL 60606-6995
Phone: (800) 366-1655
Email: hotline@eatright.org
Internet: www.eatright.org

Gluten-Free Living(bimonthly newsletter)
P.O. Box 105
Hastings-on-Hudson, NY 10706
Phone: (914) 969-2018
Email: gfliving@alo.com

Gluten Intolerance Group of Northern America
15110 10th Avenue, SW., Suite A
Seattle, WA 98166-1860
Phone: (206) 246-6652
Email: info@gluten.net
Internet: www.gluten.net

Resources

Recognizing Celiac Disease: Signs, Symptoms, Associated Disorders & Complications

Cleo J. Libonati, RN,BSN

Gluten Free Works Publishing 2007

ISBN-10:0-9788626-4-3

Living Gluten-Free Answer Book

Suzanne Bowland

Sourcebooks, Inc. 2008

ISBN-987-1-4022-1059-4

CELIAC DISEASE- A Hidden Epidemic

Peter H.R. Green, MD and Rory Jones

HarperCollins Publishers 2010

ISBN- 10:0-06-076693-X

Resources

www.celiac.com

This site also offers “The Gluten-Free Mall”

www.celiacsprue.org

www.glutenfreeinfo.com

www.celiaccenter.org

www.niddk.nih.gov/health/digest/pubs/celiac/index.htm

delightgfmagazine.com

glutenfreeliving.com

Living Without Magazine

Resources

- By going to any of the above websites, there is information on various companies that have exclusive gluten free lines of foods and cosmetics. There are also many gluten free books and manuals available at many of these web sites.
- **Animas does not control the content of these websites, therefore, cannot be held accountable for the content and claims listed therein.**

References

- Banion C, Valentine V. Type 1 diabetes throughout the life span. In: Mensing C, ed. *The Art and Science of Diabetes Self-Management Education*. Chicago, IL: American Association of Diabetes Educators; 2006:187-213.
- Borushek A. *Calorie, Fat and Carbohydrate Counter*. Costa Mesa, CA: Family Health Publications; 2009:100.
- Green P. *Celiac Disease: A Hidden Epidemic*. New York: HarperCollins; 2010.
- Green PHR, Cellier C. Celiac disease. *N Engl J Med*. 2007; 357:1731-43.
- James SP. National Institutes of Health consensus development conference statement on celiac disease, June 28-30, 2004. *Gastroenterology*. 2005;128:S1-S9.

References

- **Schwarzenberg SJ, Brunzell C. Type 1 diabetes and celiac disease: Overview and medical nutrition therapy. *Diabetes Spectrum*. 2002; 2002:197-201.**
- **See J, Murray RA, Gluten-free diet: The medical and nutrition management of celiac disease. *Nutr Clin Pract*. 2006: 21:1-15.**
- **US Food and Drug Administration. Questions and answers on the gluten-free labeling proposed rule. 2007. Available at: <http://www.cfsan.fda.gov/label.html> Accessed May 14, 2008.**
- **Walsh J, Roberts R. *Pumping Insulin, 4th ed.* San Diego, CA: Torrey Pines Press; 2006.**



Thank you very much!
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