

The Pathophysiology and Pharmacology of Celiac Disease

According to Flatekval and Deshpande (2023), celiac disease (CD) is an autoimmune disease in which the body attacks itself in the presence of gluten, a protein found in barley, rye, and wheat. Worldwide, 0.4-0.8% of people have CD (a 7.5% increase over the last several decades), and there is about a 10% chance of developing CD if a first-degree relative is also affected by it since it is hereditary (Flatekval & Deshpande, 2023). Exact statistical mortality rates of CD are scarce as most patients adhere to and respond to the gluten-free diet and have an average life expectancy (Marafini et al., 2020).

Celiac disease can develop at any time. It can be present from birth or stagnant until a trigger occurs (such as stress, pregnancy, or illness) in those who carry the gene (Flatekval & Deshpande, 2023). Non-modifiable risk factors for developing CD include a family history of CD, the presence of the HLA-DQ2 or HLA-DQ8 genes, leaky gut, and changes in the gut microbiota (Aboulaghras et al., 2022). Modifiable risk factors include preventing emotional or physical stress that may lead to the "activation" of the genes that lead to the onset of celiac disease (Flatekval & Deshpande, 2023). This paper will discuss the pathophysiology of celiac disease, the pharmacological treatments the afflicted use, and implications for nurses when providing care. In order to provide safe, competent care, nurses of celiac disease patients need an understanding of the pathophysiology of celiac disease and the nursing actions to take when providing care to someone who has or may have CD.

Pathophysiology of Celiac Disease

Pathophysiological Processes

Aboulaghras et al. (2022) state that gluten is a protein complex of glutenin and gliadin. Gliadin is particularly hazardous to celiac disease patients and is resistant to being broken down

during digestion due to a high content of the amino acids proline and glutamine (Aboulaghras et al., 2022). Long strains of gliadin peptides, such as A-gliadin P31-43, remain in the lumen of the intestine and trigger an inflammatory response by antigen-presenting cells when they interact with the intestine's epithelium (Aboulaghras et al., 2022). According to Flatekval & Deshpande (2023), tissue transglutaminase (tTg) is a calcium-dependent enzyme that cells produce during the inflammatory process, deamidating gliadin peptides. The deamidated gliadin peptides bind to the HLA DQ2/DQ8 molecules on antigen-presenting cells, and T lymphocytes target them (Aboulaghras et al., 2022). The T-lymphocytes produce inflammatory cytokines, and cytotoxic T cells attack, damaging the intestinal epithelium (Aboulaghras et al., 2022). Marafini et al. (2020) remark that this process results in epithelial death, increased intraepithelial lymphocytes, crypt hyperplasia, and villous atrophy (Marafini et al., 2020).

Diagnostically, the serology of tTg IgA is a significant indicator of celiac disease (Flatekval & Deshpande, 2023). Normal tTg IgA is < 15 U/mL (Rashin & Lee, 2016). In a celiac disease patient with gluten in their system, it can be recorded at around 250 U/mL or more (Rashin & Lee, 2016). The gold standard diagnostic indicator is endoscopy and biopsy of the small intestine, where flattened villi and crypt hyperplasia may be seen (Aboulaghras et al., 2022).

The only treatment for celiac disease is strict adherence to the gluten-free diet (Aboulaghras et al., 2022). With GFD adherence, tTg-IgA levels should dramatically drop, and the small intestine should heal, leading to the reappearance of villi (Flatekval & Deshpande, 2023). Untreated celiac disease can lead to type 1 diabetes, multiple sclerosis, a multitude of cancers, anemia, osteoporosis, infertility, migraines, epilepsy, and many more diseases (Flatekval & Deshpande, 2023).

Signs and Symptoms

A wide variety of symptoms and clinical presentations make celiac disease challenging to diagnose and treat. In response to CD's intestinal breakdown and pathophysiological process, sufferers can develop gastrointestinal symptoms such as abdominal pain, bloating, diarrhea and vomiting (Aboulaghras et al., 2022). Malabsorption and inflammation can lead to symptoms involving multiple body systems. Someone with CD might develop osteoporosis due to vitamin D deficiency, calcium deficiency, and chronic inflammation (Lebwohl & Rubio-Tapia, 2021). Some people with celiac disease experience no gastrointestinal symptoms and are diagnosed through the discovery of other medical problems, such as iron deficiency anemia, osteoporosis, or neuropathy (Vázquez-Polo et al., 2023).

Quality of Life and Nursing Interventions

With celiac disease comes difficulty attending social events with others (dinner parties, restaurants, work events), finding and preparing uncontaminated safe foods and products, high prices of gluten-free foods and feelings of isolation and depression from not being understood by others (Vázquez-Polo et al., 2023). Celiac disease is interesting in that adherence to treatment does not tend to improve quality of life, especially if a person is asymptomatic (Vázquez-Polo et al., 2023), but instead acts as a preventive measure for future disease. The above quality of life issues continue post-diagnosis and are life-long.

Nursing interventions to improve the quality of life of celiac disease patients include referrals to dietitians and counselling, screening for anxiety and depression, assessing for teaching and learning needs related to the gluten-free diet, providing resources to support groups (i.e., Celiac Canada), and connecting the patient with relevant members of the community (i.e., their pastor if they are religious). Adherence levels to treatment vary because of the restrictive and often

socially isolating nature of the GFD (Vázquez-Polo et al., 2023). The nurse can educate the patient on GFD adherence and serology/endoscopy follow-up.

Pharmacology of Celiac Disease

Since celiac disease can only be directly treated with a strict gluten-free diet (Aboulaghras et al., 2022), the pharmacology of celiac disease focuses on symptomatic treatment. Two medications that might be prescribed include iron supplementation and prednisone.

Iron Supplements

Iron is an essential mineral in hemoglobin, myoglobin, and various enzymes (Davis, 2023). Iron deficiency anemia (IDA) is the most common extraintestinal manifestation of CD, with a 12-82% prevalence in patients with a new CD diagnosis, according to a multi-study analysis completed by Talarico et al. (2021). The prevalence of IDA can be accredited to iron's absorption mode, primarily in the proximal duodenum, where the villi are destroyed in celiac disease (Talarico et al., 2021). Since most nutrients are absorbed in the small intestine, iron deficiency is just one nutritional deficiency common in CD (Talarico et al., 2021). Ferrous supplementation comes in various forms, including ferrous fumarate, ferrous gluconate, and ferrous sulfate (Davis, 2023). Brand names include Palafer, FeraMax, and Floradix. When entering the body, iron supplements are absorbed in the small intestine and then transported to the liver, spleen and bone marrow, where they are separated and become part of the body's iron stores (Davis, 2023). The various forms of iron are given predominantly PO, where about 60% of the dose is absorbed and distributed throughout the body (Davis, 2023). Certain concoctions, such as iron dextran and sodium ferric gluconate complex, can be given IM or IV and are indicated when a patient cannot tolerate PO iron or when a patient is undergoing hemodialysis or peritoneal dialysis, respectively (Davis, 2023). Most patients can tolerate PO administration, making iron supplementation a

predominant at-home treatment. Sicker patients on hemo or peritoneal dialysis may have to remain in the hospital for IV treatment. Iron supplements are appropriate for children and adults.

A patient on iron supplements should expect to feel more energized with more activity tolerance and less daily lethargy (Davis, 2023) as their iron stores return to normal. Common side effects of iron include nausea, constipation, dark stools, diarrhea, and epigastric pain (Davis, 2023). Avoid taking iron supplements with drugs such as tetracyclines, levothyroxine and bisphosphonates, and avoid concurrent administration with food if possible (Davis, 2023), as it decreases absorption by 33-35%. If food administration is necessary to avoid gastrointestinal upset, avoid using dairy, caffeine, eggs, and whole-grain bread (Davis, 2023). Contraindications for iron supplementation include those with hemochromatosis, hemosiderosis, and anemia unrelated to iron deficiency (Davis, 2023). Nursing implications of iron supplementation include reviewing ferritin, hematocrit, and hemoglobin levels on a CBC, assessing bowel function, taking a dietary history and assessing the need for patient teaching and watching for signs and symptoms of anaphylaxis and hypersensitivity like rash, wheezing, hypotension, laryngeal edema and pruritus (Davis, 2023). Other considerations include assessing gastrointestinal symptoms throughout treatment and encouraging patients to take their iron at a specific time daily, avoiding double dosing (Davis, 2023). Stress that it is better to miss a dose than double dose and warn them that their stools may be black or dark green and that this is normal (Davis, 2023). Iron overdose can be hazardous and even fatal, especially in children, which is why it is essential to review CBC values and to stress to parents to keep iron away from children's reach and not to refer to the supplements as candy (Davis, 2023). Iron is a safe supplement for iron-deficiency anemia, and normalization of the iron stores usually occurs from 6 months to 2 years (Talarico et al., 2021).

Prednisone

Systemic glucocorticoids like prednisone may be used during acute and severe flare-ups or if a patient has refractory celiac disease, which is when the body does not react to the GFD and villi damage continues (Medscape, 2019). Prednisone is an anti-inflammatory and immunosuppressant with a sizeable adverse effect profile that makes it unsuitable for long-term use (Medscape, n.d.). It is converted in the liver to metabolite prednisolone, an agonist for glucocorticoid receptors, and excreted via the kidneys (Medscape, n.d.). Once bound to receptors, it reduces the inflammatory response, reversing capillary permeability and the chemotaxis of leukocytes to the site of inflammation (Medscape, n.d.). Taking prednisone should reduce symptoms related to inflammation, such as pain, fatigue, digestive issues and dermatitis herpetiformis, a rash that some people with CD get after ingesting gluten (Medscape, 2019). Suffixes for these glucocorticoids include -sone and -lone (Medscape, n.d.).

The predominantly oral nature of prednisone makes it a medication clients can conveniently take at home. Patients can take prednisone with a meal or snack and a large glass of water to reduce gastrointestinal upset (Medscape, n.d.). Common side effects include nausea, vomiting, heartburn, increased appetite, weight gain, or acne (Medscape, n.d.). Contraindications include active infections and the co-administration of mifepristone (Medscape, n.d.). Used cautiously in those with bone disorders, bipolar and peptic ulcers (Medscape, n.d.), as prednisone comes with a risk of suppressed osteoblast formation, triggering mania and agitating peptic ulcers, causing GI bleeds.

Serious concerns include the suppressed normal function of the adrenal gland, hyperglycemia, mood changes, cataracts, peptic ulcers, and electrolyte imbalances (Medscape, n.d.). Nursing considerations include warning the patient not to stop this medication suddenly without talking

to a doctor, as abrupt cessation can lead to adrenal dysfunction (Medscape, n.d.). Monitor the blood sugars of people with diabetes carefully, as hyperglycemia is a known side effect (Medscape, n.d.). Take the patient's body weight before and during glucocorticoid therapy and review and compare labwork from before and during treatment, including CBC, serum glucose, and sodium/potassium levels (Medscape, n.d.). Monitor and be aware of the risk for fluid and electrolyte imbalance (Medscape, n.d.) and watch for signs and symptoms of anaphylaxis and hypersensitivity like rash, wheezing, hypotension, laryngeal edema and pruritus.

Summary

As an autoimmune disease that exerts its effects on the gut, celiac disease is known for its gastrointestinal side effects. However, health professionals should be aware that CD can manifest in many extraintestinal ways and that some celiacs may not be obviously symptomatic at all. Regardless of the type or amount of symptoms, CD should be taken seriously, and the importance of a GFD should be stressed to all patients. Pharmacology for CD is symptom-based, as nothing can cure the underlying cause, and the best treatment is a complete GFD. Medications may include nutritional supplements such as iron and anti-inflammatories such as prednisone. Nursing interventions for CD include referrals to specialists, educating patients about the GFD, and connecting patients to peer support in the community. With the proper knowledge and good intentions, nurses can make a difference in CD patients' lives and improve their quality of life.