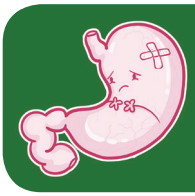

# NOTES
## MALABSORPTION CONDITIONS

## GENERALLY, WHAT ARE THEY?

### PATHOLOGY & CAUSES

- Impaired ability of gastrointestinal tract to absorb nutrients
- Malabsorption may be
  - Global → impaired function of intestinal cells
  - Partial → external agent interferes with absorption
- Manifestation of underlying illness; may be congenital/acquired/infectious

#### CAUSES

- Defects in absorption process of intestinal cells (e.g. change to bowel surface area)
- Impaired nutrient digestion (e.g. altered digestive enzymes)

### SIGNS & SYMPTOMS

- Abdominal distention, pain
- Chronic diarrhea, malabsorption, dehydration
- Weight loss
- Clinical manifestations of nutritional deficiencies (e.g. paresthesias from cobalamin deficiency)

### DIAGNOSIS

#### DIAGNOSTIC IMAGING

- Abdominal ultrasound, colonoscopy, intestinal biopsy, serological markers

#### LAB RESULTS

- D-xylose test
  - Test for carbohydrate malabsorption
- Fecal fat testing
- Complete blood count (CBC)
  - Look for for infection, anemia

#### OTHER DIAGNOSTICS

- Individual history
  - Pancreatitis
  - Recent surgeries
  - Symptoms of vitamin deficiency
  - Family history

### TREATMENT

- See individual disorders

# CELIAC DISEASE

osms.it/celiac-disease

## PATHOLOGY & CAUSES

- Autoimmune disorder of small intestine
- AKA gluten-sensitive enteropathy/ nontropical sprue

### CAUSES

- Triggered by foods containing gliadin, a peptide found in foods containing gluten (e.g. grains: wheat, barley, rye, oats)
  - Gluten consumption → degradation into peptides in small intestine → secretory IgA binds to gliadin in duodenum → IgA-gliadin complex binds to transferrin receptor → IgA-gliadin complex travels across enterocyte into lamina propria → tissue transglutaminase deaminates gliadin → macrophages uptake, present deaminated gliadin in MHC-2 molecules HLA-DQ 2, 8 → CD4+ activation → inflammatory cytokines released (interferon gamma, tumor necrosis factor) → damage/destruction of intestinal villi → B cell activation → anti-gliadin, anti-tissue transglutaminase, antiendomysial antibodies released → CD8+ cell activation → tissue destruction
- On microscopy
  - Villous atrophy, mucosal inflammation, intestinal crypt hyperplasia
- Presence of anti-gliadin, anti-endomysium IgA = pathognomonic

### RISK FACTORS

- Northern European ancestry, genetic component

## SIGNS & SYMPTOMS

- Abdominal distention, chronic diarrhea (steatorrhea)
- Failure to thrive (children)
- Dermatitis herpetiformis
  - Circulating IgA antibodies attack dermal papillae → generalized rash

## DIAGNOSIS

### LAB RESULTS

- Anti-gliadin IgA/IgG
- Anti-endomysium IgA
- Anti-tissue transglutaminase IgA
  - *Tissue transglutaminase:* endomysial enzyme released in response to cellular stress
  - More sensitive, specific

#### Duodenal biopsy

- Showing lymphocytic infiltration, villous atrophy, crypt hyperplasia

## TREATMENT

### OTHER INTERVENTIONS

- Correct nutritional deficiencies related to malabsorption

#### Preventative

- Gluten-free diet

**MNEMONIC: Grains are BROWn**

**Grains to avoid with Celiac disease**

**B**arley
**R**ye
**O**ats
**W**heat

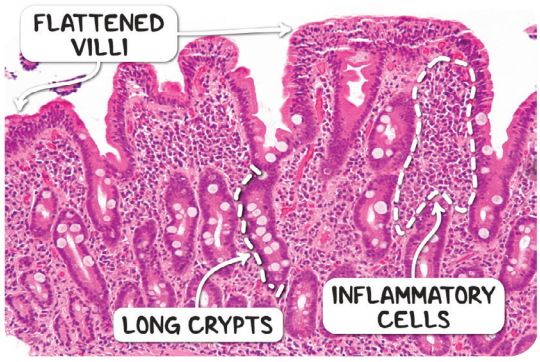


**Figure 38.1** Histological appearance of a duodenal biopsy in an individual with celiac disease. There is villous blunting, an expansion of the lamina propria by chronic inflammatory cells and an increase in crypt length. A higher magnification would reveal an increase in lymphocyte count in the surface epithelium.

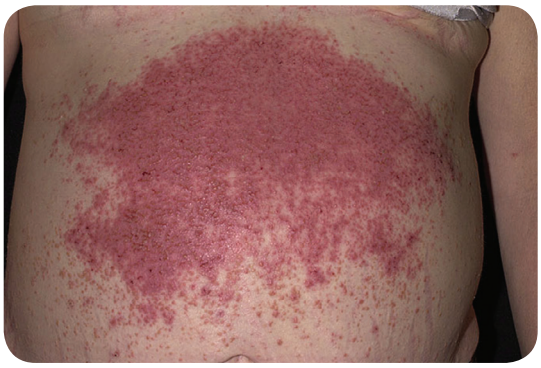

**Figure 38.2** Clinical appearance of dermatitis herpetiformis. Individual with celiac disease are at increased risk of this condition.

# LACTOSE INTOLERANCE

**osms.it/lactose-intolerance**

## PATHOLOGY & CAUSES

- Decreased ability to digest lactose
- Lactose consumption → lactase deficiency/inactivity → ↑ undigested lactose → fermentation by colonic flora → gas, osmotically active substances produced → bloating, diarrhea

### CAUSES

- Most often acquired due to physiologic weaning off of milk

### RISK FACTORS

- Non-European ancestry (most common)
- Increases with age
- May be congenital
  - Rare, autosomal recessive disorder
- May be developmental
  - Most common among premature infants
- Underlying intestinal disease

## SIGNS & SYMPTOMS

- Occur after consuming lactose (e.g. milk, cheese)
- Abdominal pain, cramping in lower quadrants
- Abdominal distention, flatulence, vomiting, diarrhea (more common in children)

## DIAGNOSIS

- Based on above symptoms

### LAB RESULTS

- Unabsorbed carbohydrates → high stool osmotic gap
- Bacterial lactose fermentation → acidic stool pH

## TREATMENT

### OTHER INTERVENTIONS

- Optimize calcium, vitamin D intake

**Preventative**

- Lactose-free diet
  - Compensate with lactase

# SMALL BOWEL BACTERIAL OVERGROWTH SYNDROME

osms.it/sbbos

## PATHOLOGY & CAUSES

- Excessive colonic bacteria colonizing small intestine
- Often occurs secondary to conditions limiting intestinal motility, gastric acid and bile secretion and IgA deficiencies

### CAUSES

- Alteration of factors regulating intestinal flora → aerobic bacteria proliferation → changes in aerobic microclimate of small intestine → migration of colonic anaerobic bacteria → damage to intestinal surface → maldigestion, malabsorption → symptoms
  - ↑ bacteria → ↑ carbohydrate metabolism → ↑ gas production → bloating
  - ↑ bacteria → bile acid inactivation → ↑ fat in colon → osmotic effect → diarrhea
  - ↑ bacteria → intrinsic factor degradation → impaired $B_{12}$ absorption → $B_{12}$ deficiency

### RISK FACTORS

- Increases with age

## SIGNS & SYMPTOMS

- Abdominal pain/distention, chronic diarrhea, flatulence
- Tympanitic abdomen upon percussion
- Altered mental status after high carbohydrate meal
- Failure to thrive (children)

## DIAGNOSIS

### LAB RESULTS

- Signs/symptoms of vitamin, electrolyte abnormalities
  - Weakness, ataxia, paresthesias → $B_{12}$ deficiency
  - Perioral numbness, feet paresthesias, muscle cramping → calcium deficiency
- Anemia
  - Macrocytic → $B_{12}$ deficiency
  - Microcytic → chronic bleeding
- Fecal fat testing
- Lactulose/glucose breath testing
- Jejunal aspirate, culture
  - > $10^3$ colony forming units

### OTHER DIAGNOSTICS

- Individual history
  - Chronic pancreatitis, intestinal surgery, GI neuropathy

## TREATMENT

### MEDICATIONS

- Antibiotics

# TROPICAL SPRUE

osms.it/tropical-sprue

## PATHOLOGY & CAUSES

- Gastrointestinal disease of uncertain etiology resulting in nutrient malabsorption

### CAUSES

- Acute intestinal infection (viral/bacterial/protozoan) → damaged intestinal lining → inflammation → enteroglucagon secretion → decreased intestinal motility → increased intestinal transit time → overgrowth of *Klebsiella*, *E. coli*, *Enterobacter* → production of toxic fermentation byproducts → further inflammation → villous atrophy → malabsorption → depletion of folate, $B_{12}$ → intestinal villi can't function normally → further intestinal injury, megaloblastic anemia

### RISK FACTORS

- Most common in individuals living in tropical regions

## SIGNS & SYMPTOMS

- Diarrhea, weight loss, dehydration, abdominal pain, fatigue, megaloblastic anemia

## DIAGNOSIS

### DIAGNOSTIC IMAGING

**Endoscopy**

**Barium swallow**

- Shows intestinal wall thickening

### LAB RESULTS

- Fecal fat test
- D-xylose test
- Jejunal biopsy
  - Shows villous atrophy, inflammation

## TREATMENT

### MEDICATIONS

- Antibiotics → reduce bacterial overgrowth
- Replace folate, $B_{12}$

# WHIPPLE'S DISEASE

osms.it/whipples-disease

## PATHOLOGY & CAUSES

- Rare, malabsorptive infectious disease caused by *Tropheryma whipplei*
- Pathognomonic finding → lamina propria displays numerous macrophages with periodic acid-Schiff (PAS) positive intracellular material

### CAUSES

- *Tropheryma whipplei*
  - Gram-positive, non-acid fast, PAS positive bacillus; ubiquitous in environment
  - Fecal-oral transmission
- Readily spreads throughout body, causing multisystem effects
  - Evades immune response → allows for accumulation of bacilli in tissues
- Current hypothesis suggests host immunodeficiency as predisposing factor

### RISK FACTORS

- Middle-aged biological males of European ancestry; exposure to fecal matter (sewage workers, farmers)

### MNEMONIC: WHIPPLES

**Features of Whipple's disease**

**W**eight loss
**H**yperpigmentation of skin
**I**nfection with *tropheryma whippelii*
**P**AS positive granules in macrophage
**P**olyarthritis
**L**ymphadenopathy
**E**nteric involvement
**S**teatorrhea

## SIGNS & SYMPTOMS

- Four cardinal signs
  - Diarrhea, weight loss, abdominal pain, arthralgias
- Endocarditis, pericarditis, myocarditis
- Skin hyperpigmentation
- Pleural disease

## DIAGNOSIS

### LAB RESULTS

- Biopsy
  - Shows copious PAS positive macrophages invading lamina propria in intestine
- ≥ two positive PCR/PAS tests
- Immunohistochemistry for *T. whipplei*
- Laboratory findings suggesting chronic inflammation, nutritional deficits

## TREATMENT

### MEDICATIONS

- Start with IV antibiotics → ceftriaxone/penicillin G
- Trimethoprim-sulfamethoxazole (1 year)

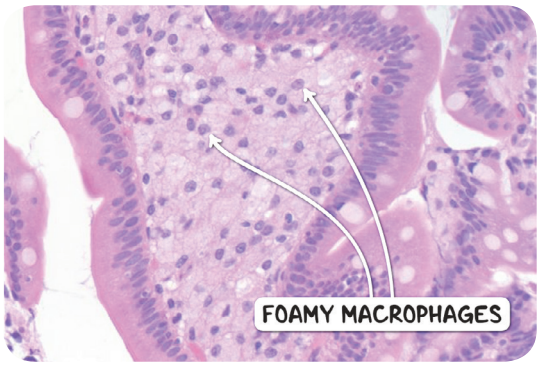


**Figure 38.3** Histological appearance of the duodenum in a case of Whipple's disease. The lamina propria is occupied by numerous foamy macrophages. Electron microscopy would reveal numerous membrane bound bacilli.

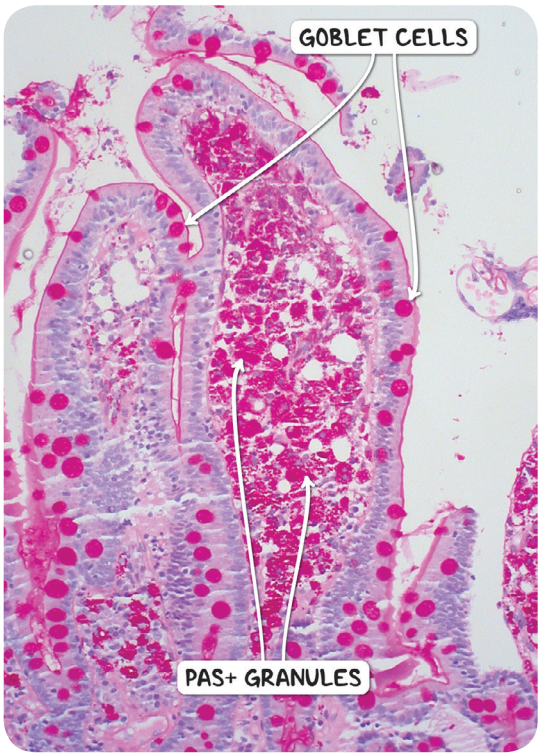


**Figure 38.4** Histological appearance of a duodenal biopsy with the special stain DPAS (diastase periodic acid-Schiff). This stain highlights diastase resistant mucin within the foamy macrophages residing in the lamina propria. The mucin within goblet cells is also positively stained.