

# GNT

Pathology lecture

## Pathology and mechanisms of malabsorption

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# Objectives

Upon completion of this lecture the students will:

1. Understand that the malabsorption is caused by either abnormal digestion or small intestinal mucosal disease
2. Know that malabsorption can affect many organ systems (alimentary tract, hematopoietic system, musculoskeletal system, endocrine system, epidermis, nervous system)
3. Know the following aspects of celiac disease:
  - a. definition
  - b. pathogenesis
  - c. clinical features
  - d. pathology (gross and microscopic features)
  - e. complications (T-cell lymphoma and GI tract carcinoma)
4. Know the cause and types of Lactose intolerance

# Malabsorption Syndrome

Inability of the intestine to absorb nutrients adequately into the blood stream

Impairment can be of single or multiple nutrients depending on the abnormality

# Physiology

- The main purpose of the gastrointestinal tract is to digest and absorb nutrients (fat, carbohydrate, and protein), micronutrients (vitamins and trace minerals), water, minerals and electrolytes.

## Mechanisms and Causes of Malabsorption Syndrome

**1. Inadequate digestion**

**2. Deficient bile salt**

**3. Primary mucosal abnormalities**

**4. Inadequate small intestine**

**5. Lymphatic obstruction**

# Mechanisms and Causes of Malabsorption Syndrome

## Inadequate digestion

- Postgastrectomy
- Deficiency of pancreatic lipase
- Chronic pancreatitis
- Cystic fibrosis
- Pancreatic resection
- Zollinger-Ellison syndrome

## Deficient bile salt

- Obstructive jaundice
- Bacterial overgrowth
- Stasis in blind loops, biliary calcula
- Fistulas
- Hypomotility states (diabetes)
- Terminal ileal resection
- Crohns' disease
- Precipitation of bile salts (neomycin)

## Primary mucosal abnormalities

- Celiac disease
- Tropical sprue
- Whipple's disease
- Amyloidosis
- Radiation enteritis
- Abetalipoproteinemia
- Giardiasis

## Inadequate small intestine

- Intestinal resection
- Crohn's disease
- Mesenteric vascular disease with infarction
- Jejunioileal bypass

## Lymphatic obstruction

- Intestinal lymphangiectasia
- Malignant lymphoma
- Macroglobulinemia

Many causes

# Pathophysiology

Inadequate digestion

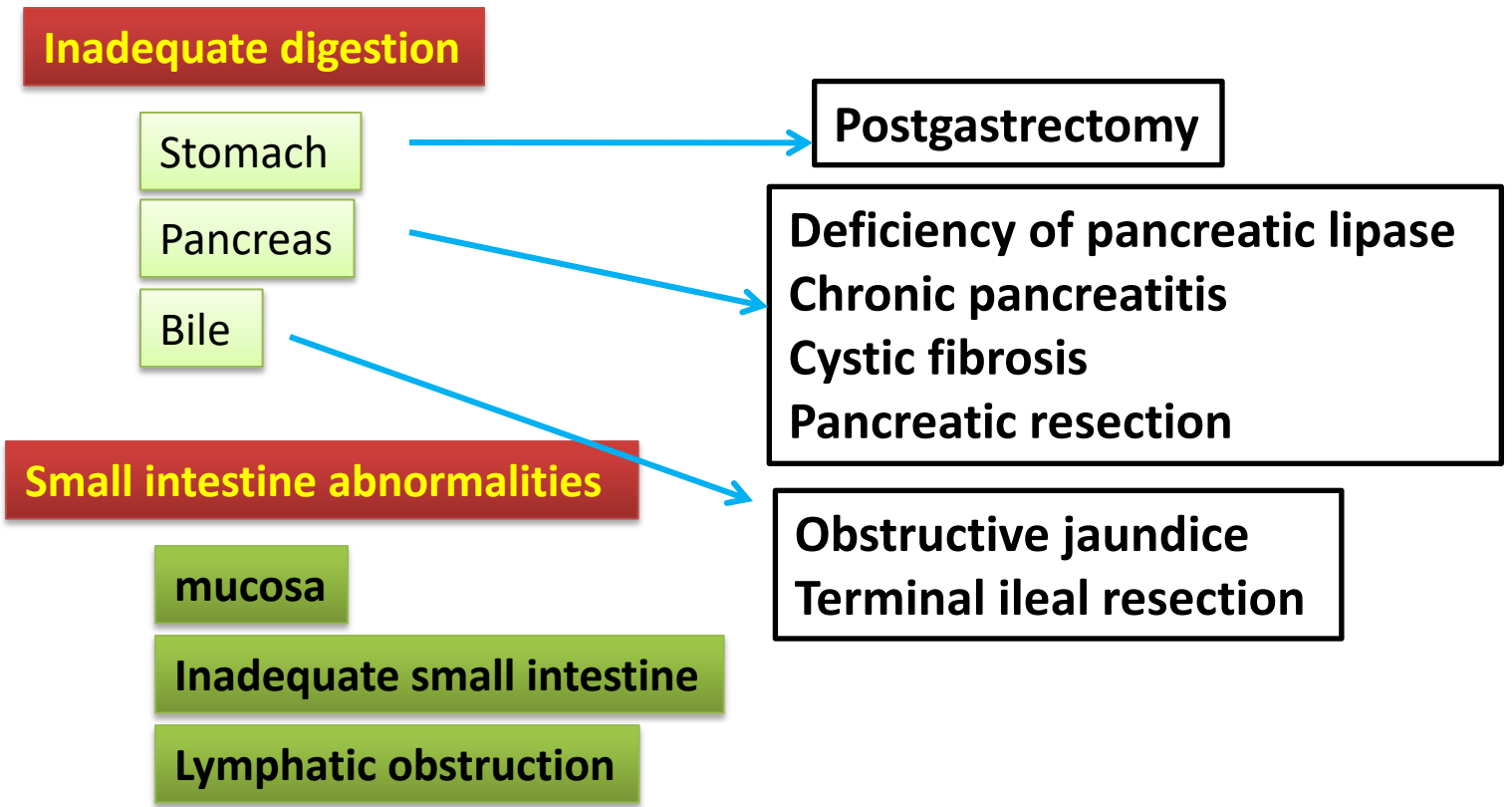
Or

Small intestine abnormalities

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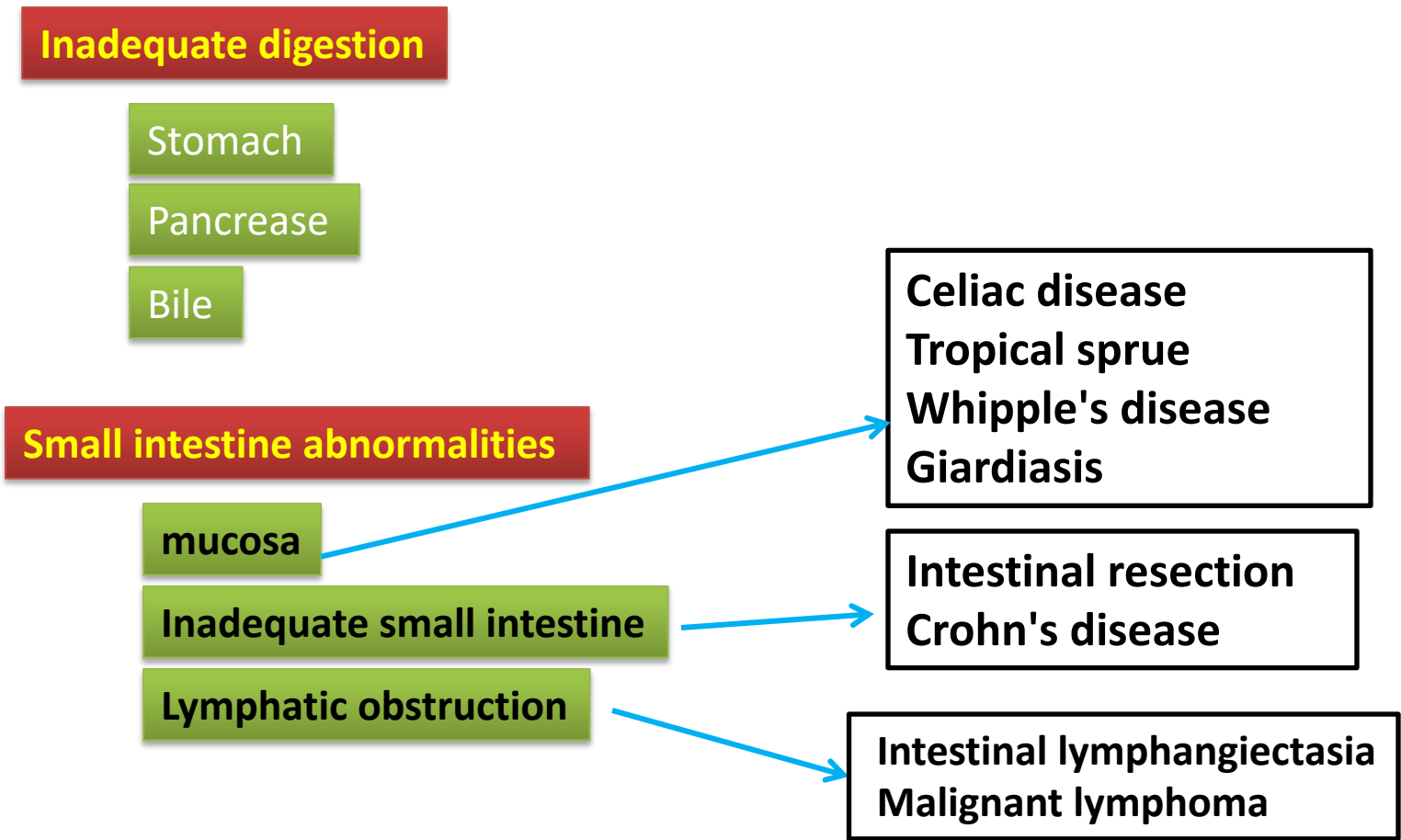
Malabsorption

# Pathophysiology





# Pathophysiology



# Malabsorption Syndrome

## Clinical features

1. There is increased fecal excretion of fat (**steatorrhea**) and the systemic effects of deficiency of vitamins, minerals, protein and carbohydrates.

**Steatorrhea** is passage of soft, yellowish, greasy stools containing an increased amount of fat

2. Growth retardation and failure to thrive in children
3. Weight loss despite increased oral intake of nutrients

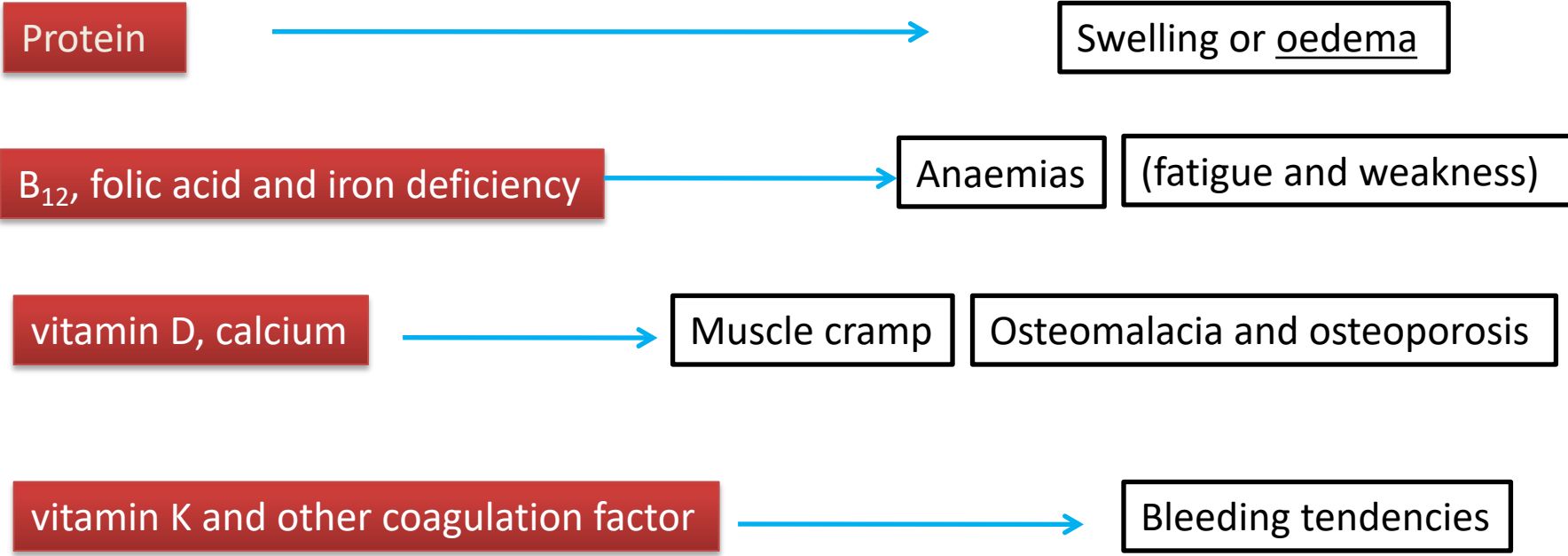
# Systemic effects of the malabsorption syndromes

- Weight loss and anorexia
- Abdominal distension and borborygmi (increased bowel sounds)
- Diarrhoea (loose, bulky stools)
- Steatorrhoea—malabsorption of fat, producing pale, foul-smelling stools that characteristically float in water
- Muscle wasting

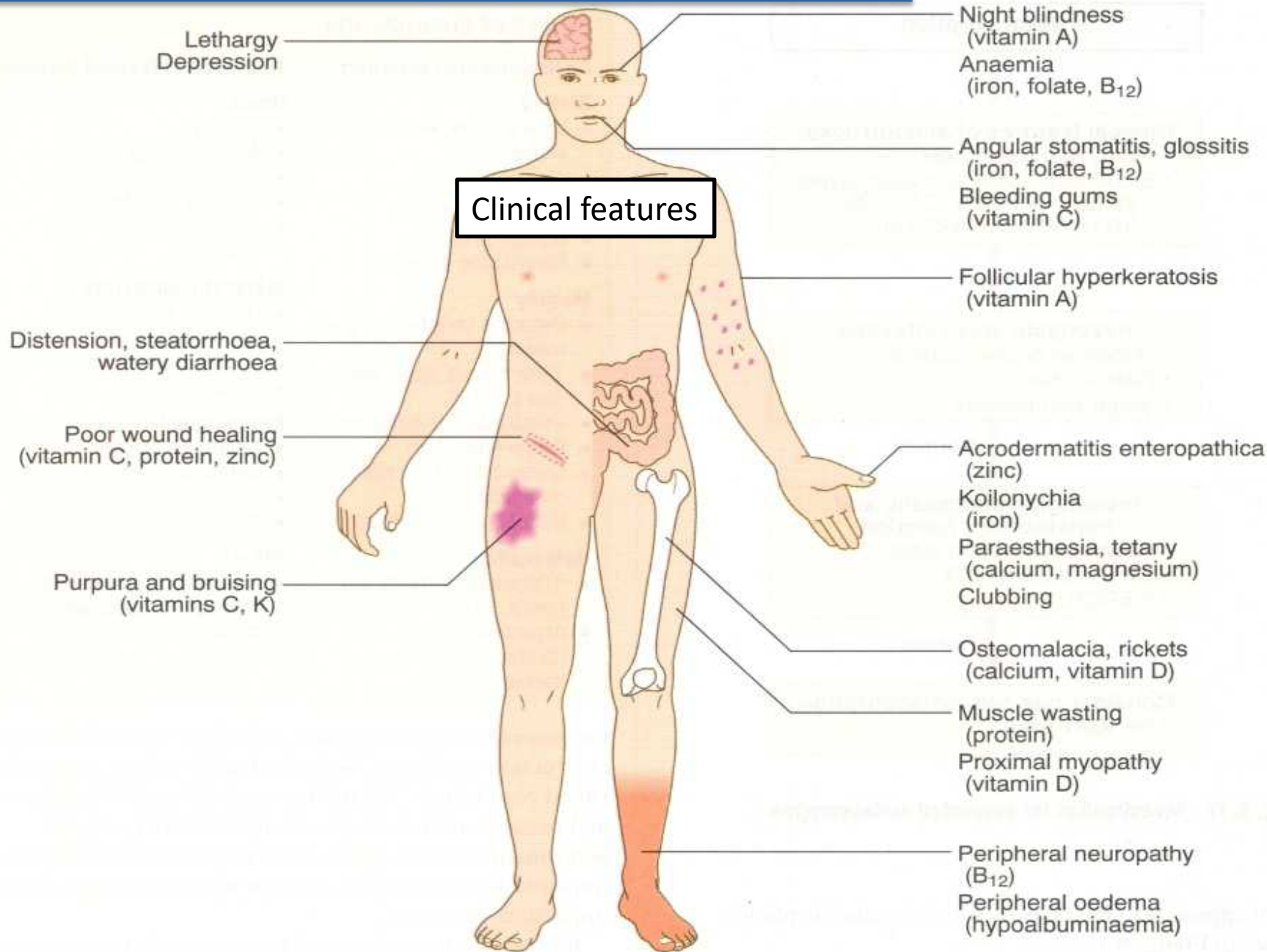
# Malabsorption Syndrome

## Clinical features

Depend on the deficient nutrient



# Know that malabsorption can affect many organ systems



# Diagnosis

There is no specific test for malabsorption.  
Investigation is guided by symptoms and signs.

1. Fecal fat study to diagnose steatorrhoea
2. Blood tests
3. Endoscopy

Biopsy of small bowel

## Malabsorption Syndrome

### *Celiac disease*

An immune reaction to **gliadin** fraction of the **wheat** protein **gluten**

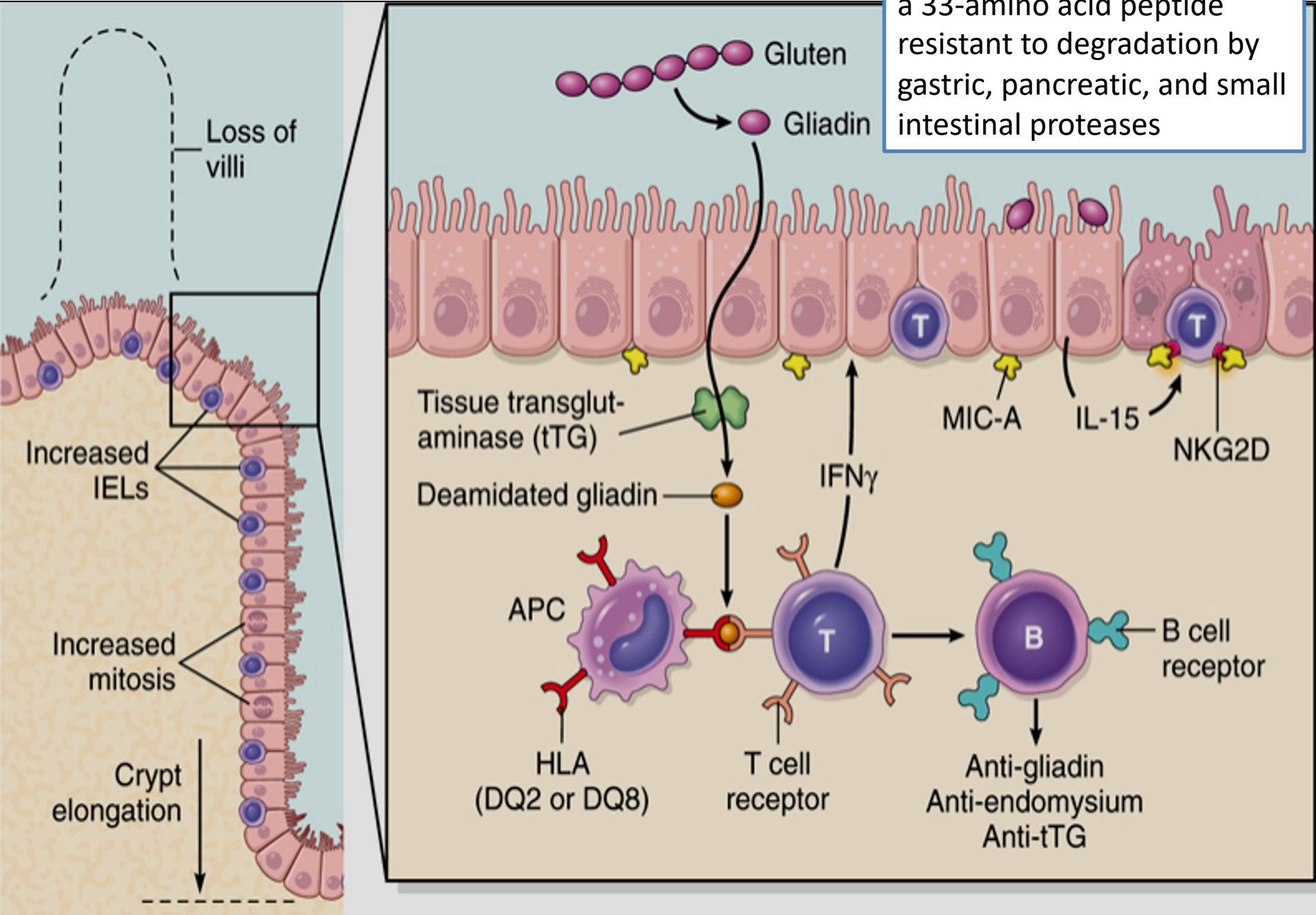
Usually diagnosed in childhood – mid adult.

Patients have raised antibodies to gluten  
autoantibodies

Highly specific association with class II HLA-DQ2  
or HLA-DQ8 alleles.

# Celiac disease

a 33-amino acid peptide resistant to degradation by gastric, pancreatic, and small intestinal proteases





# Clinical features

## Celiac disease

### **Typical presentation**

GI symptoms that characteristically appear at age 9-24 months. Symptoms begin at various times after the introduction of foods that contain gluten.

### **A relationship between the age of onset and the type of presentation;**

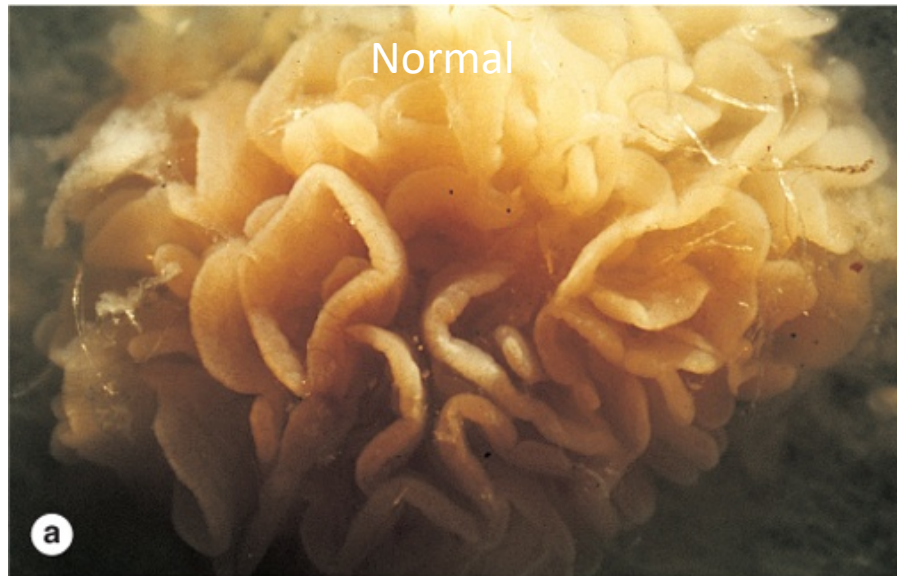
**Infants and toddlers**....GI symptoms and failure to thrive

**Childhood**.....minor GI symptoms, inadequate rate of weight gain,

**Young adults**.....anemia is the most common form of presentation.

**Adults and elderly**.....GI symptoms are more prevalent

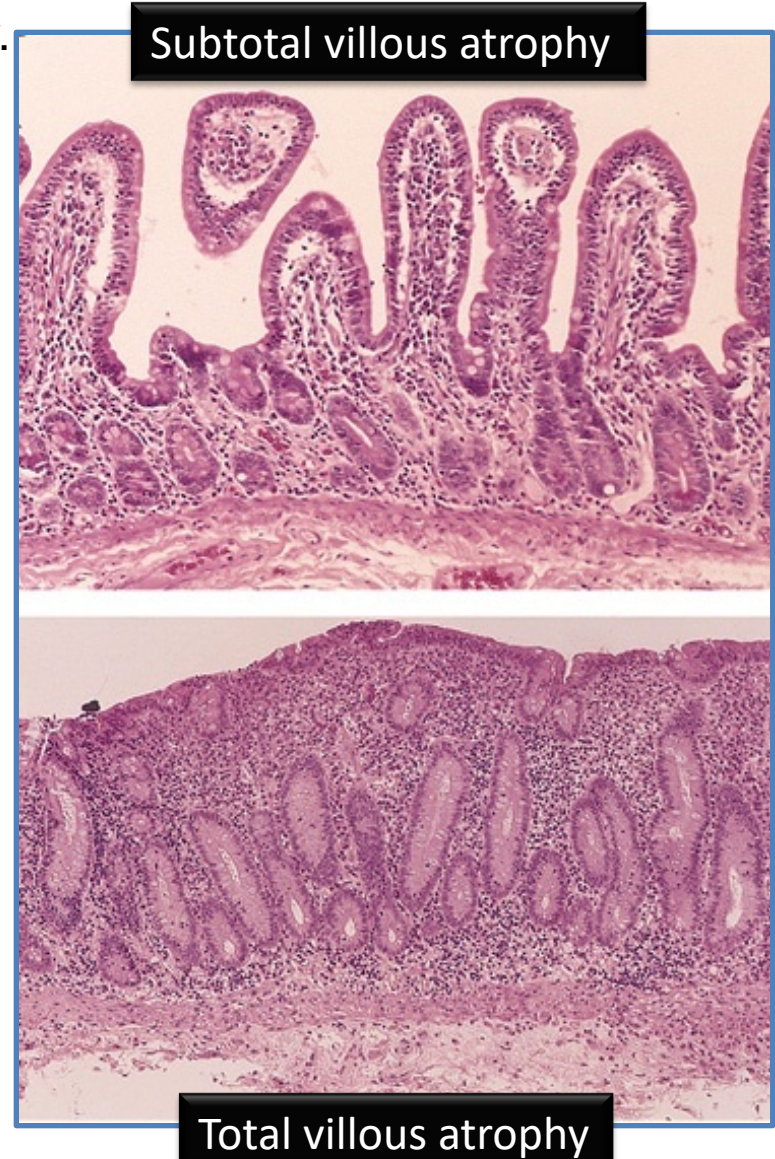
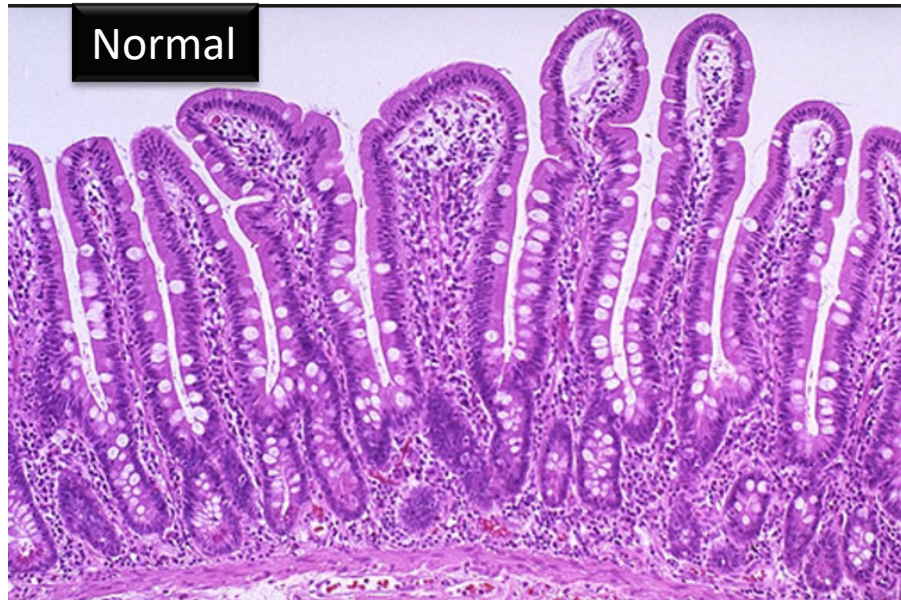
# Endoscopy



# Celiac Disease

## Histology

- Mucosa is flattened with marked villous atrophy.
- Increased intraepithelial lymphocytosis
- Crypt elongation



# Celiac Disease

## Diagnosis

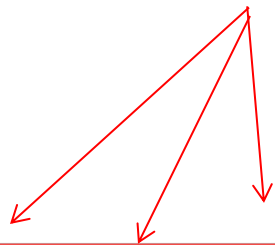
Clinical documentations of malabsorption.

Stool .....↑..... Fat

Serology is +ve for IgA to tissue transglutaminase or IgG to deamidated gliadin or anti-endomysial antibodies

Small intestine biopsy demonstrate villous atrophy.

Improvement of symptom and mucosal histology on gluten withdrawal from diet.



wheat, barley, flour  
Other grains, such as rice and corn flour, do not have such an effect.

# Celiac Disease

## Complications

Osteopenia , osteoporosis

Infertility in women

Short stature, delayed puberty, anemia,

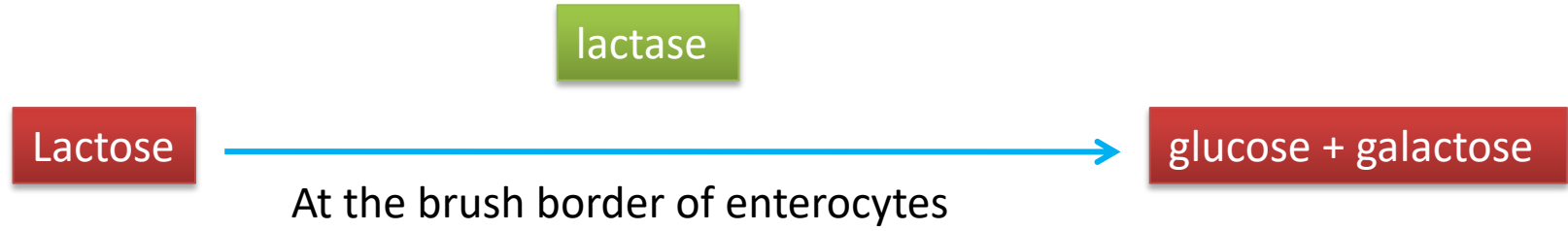
Malignancies: [intestinal T-cell lymphoma]

10 to 15% risk of developing GI lymphoma.

# Lactose Intolerance

# Lactose Intolerance

## Pathophysiology



**Lactose Intolerance**

Low or absent activity of the enzyme lactase

# Lactose Intolerance causes

## Inherited lactase deficiency

### *Congenital lactase deficiency*

extremely rare

### Childhood-onset and adult-onset lactase deficiency

common

Genetically programmed progressive loss of the activity of the small intestinal enzyme lactase.

**Gastroenteritis: Infectious diarrhea, particularly viral gastroenteritis in younger children, may damage the intestinal mucosa enough to reduce the quantity of the lactase enzyme**

## Acquired lactase deficiency

Transient

Secondary lactase deficiency due to intestinal mucosal injury by an **infectious, allergic, or inflammatory process**



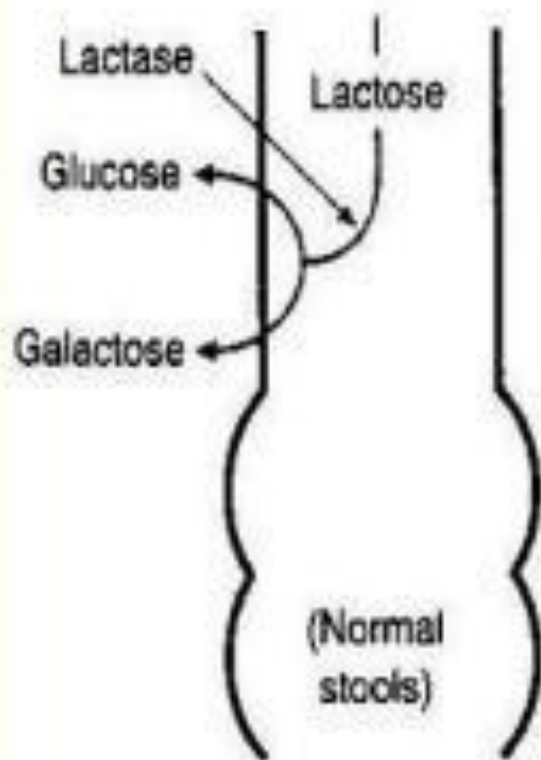
# Clinical

Bloating, abdominal discomfort, and flatulence

.....1 hour to a few hours after ingestion of milk products

# Lactose Intolerance

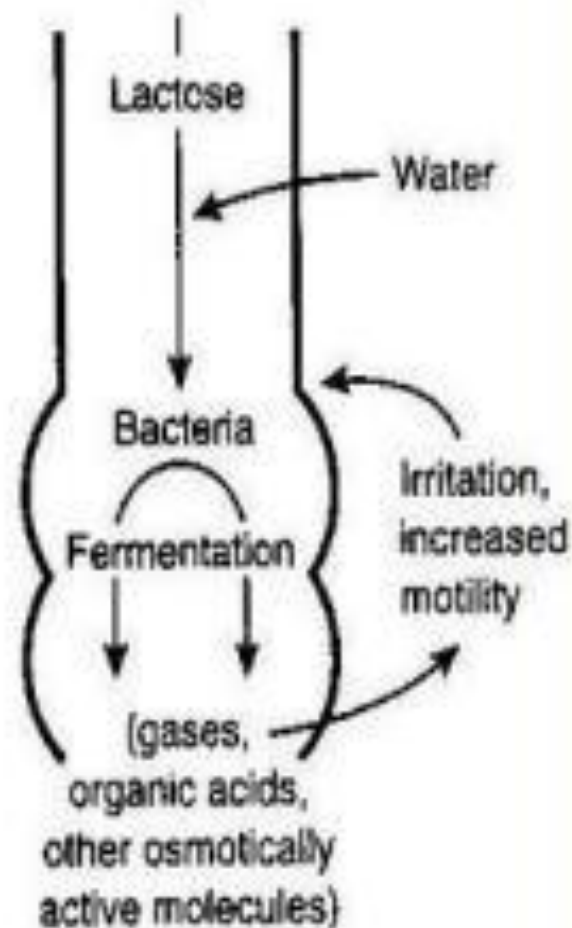
Normal lactose digestion



Lactose intolerance

Small intestine

Large intestine



# Lactose Intolerance

## Diagnosis

Empirical treatment with a lactose-free diet,  
which results in resolution of symptoms;

Hydrogen breath test

# Hydrogen breath test .

- An oral dose of lactose is administered
- The sole source of  $H_2$  is bacterial fermentation;
- Unabsorbed lactose makes its way to colonic bacteria, resulting in excess breath  $H_2$ .
- Increased exhaled  $H_2$  after lactose ingestion suggests lactose malabsorption.

A 3-week trial of a diet that is free of milk and milk products is a satisfactory trial to diagnose lactose intolerance

# Lactose Intolerance

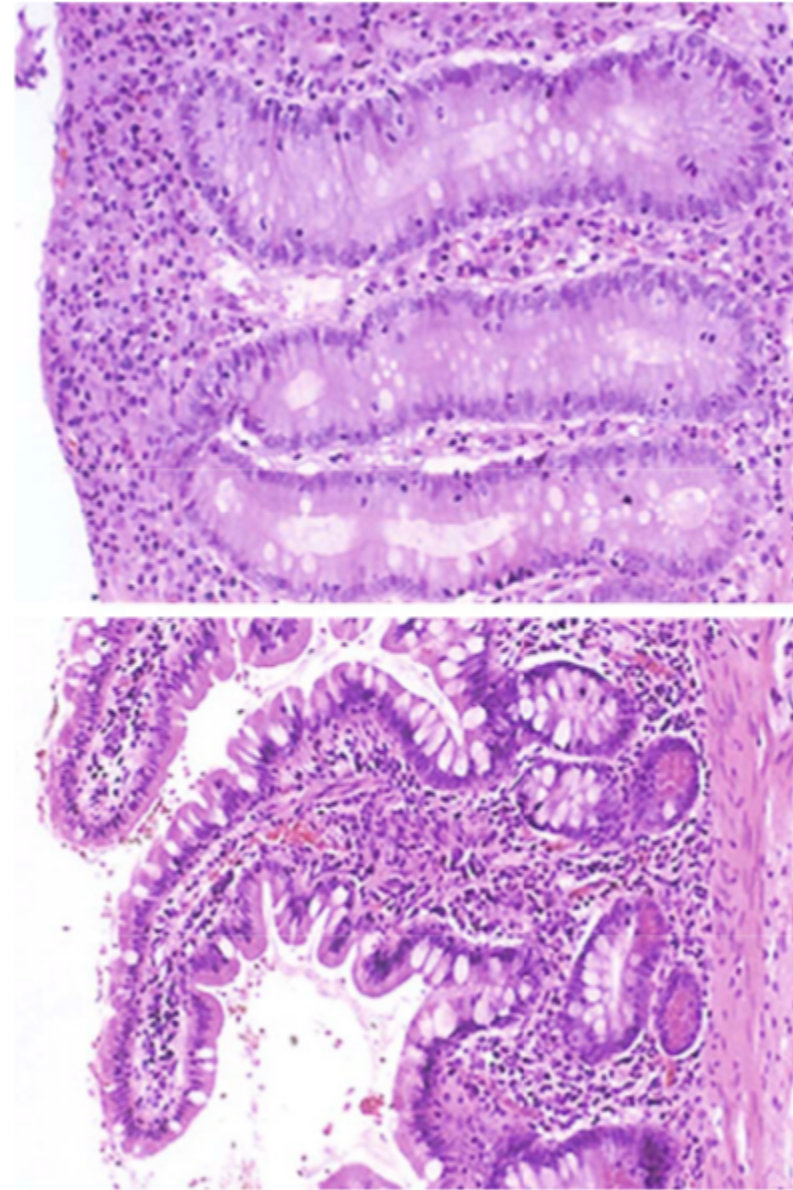
## summary

- Deficiency/absence of the enzyme lactase in the brush border of the intestinal mucosa → maldigestion and malabsorption of lactose
- Unabsorbed lactose draws water in the intestinal lumen
- In the colon, lactose is metabolized by bacteria to organic acid, CO<sub>2</sub> and H<sub>2</sub>; acid is an irritant and exerts an osmotic effect
- Causes diarrhea, gaseousness, bloating and abdominal cramps



## Questions

A 33-year-old man with a 5-year history of chronic diarrhea has recently lost 6 kg and become chronically fatigued. A biopsy specimen of his jejunum (*top*) is compared with a normal jejunal biopsy specimen. After a change in diet, he improves.





## Q1. What is your diagnosis?

*The flattening with atrophy of the villi, the loss of goblet cells, and the chronic inflammation are features of **celiac disease** (nontropical sprue or gluten-sensitive enteropathy).*

## Q2. What serologic tests can aid in diagnosis?

*Testing for antiendomysial antibodies (directed against transglutaminase in epithelial cells), antigliadin antibodies, and antireticulin antibodies may be helpful.*

## Q3. What was the dietary change?

***Gluten** (found in wheat, rye, or barley flour) contains the **gliadin** protein that binds to epithelial cells; cytotoxic T cell injury directed against gliadin-modified cells leads to cell loss. The removal of gluten (gliadin) from the diet removes the antigenic stimulus to the T cells, and the epithelium is eventually restored.*

## Q4. What skin condition can accompany this disease?

***Dermatitis herpetiformis**, with sub-basilar skin blistering and associated IgA deposition, may occur with this condition.*

# Question

- A 23-year-old woman from Hong Kong who is living in Zurich has had bouts of explosive, watery diarrhea with abdominal bloating since her arrival 6 months ago. Her stool has no occult blood, ova, parasites, or bacterial pathogens. Her laboratory findings are shown.

**Vitamin B<sub>12</sub>**

450 pg/mL (nl 200–800 pg/mL)

**Folate**

11 ng/mL (nl >1.9 ng/mL)

**Antiendomysial antibody (EMA)**

Negative

**Quantitative stool fat, 72 hours**

3 gm (within normal limits)

**D-xylose absorption**

35% excretion in 5 hours (within normal limits)

**Bile salts**

Normal

**Hydrogen breath test**

Increased early peak

## 1. What is your diagnosis?

***lactase deficiency.** Disaccharidases are secreted from apical enterocytes, with infants expressing more than adults. Europeans typically have more lactase expression than Asians do.*

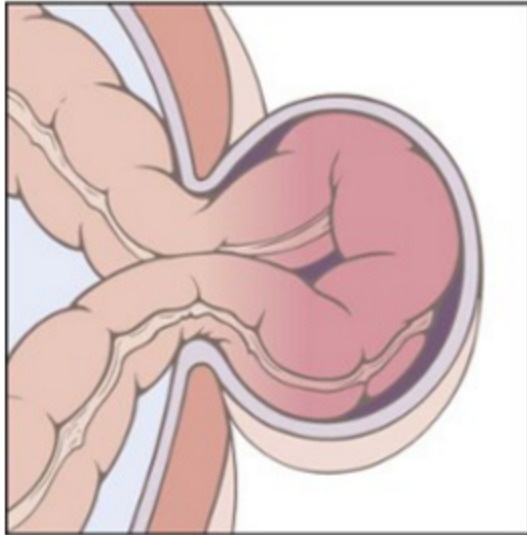
## 2. What is the pathogenesis?

*When disaccharides are not absorbed, gut bacteria have increasing substrate to ferment, which produces hydrogen that is absorbed and exhaled. It is the bacterial overgrowth and osmotic diarrhea that cause the unpleasant symptoms.*

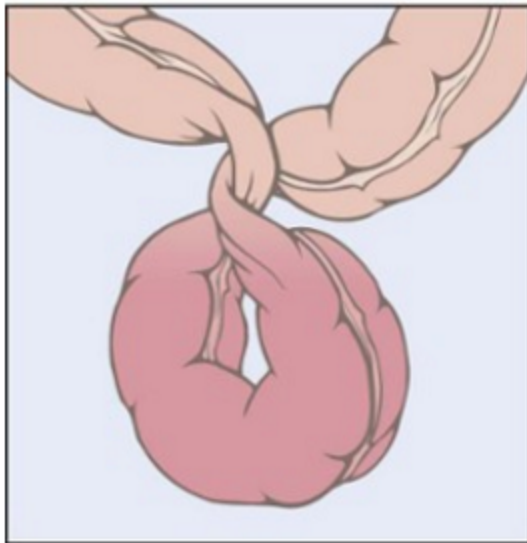
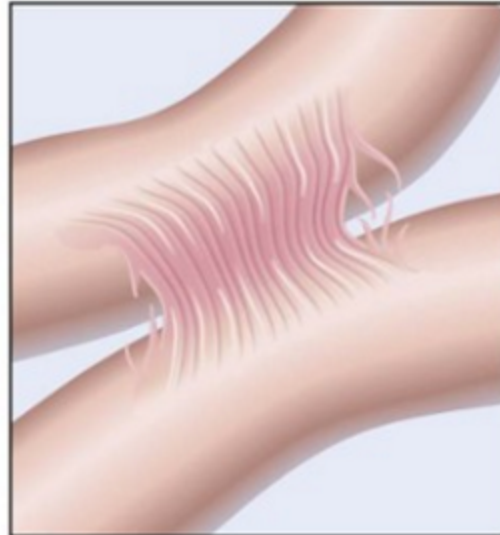
## 3. How can this be treated?

*Avoiding foods containing lactose sugar include dairy products will reduce the symptoms.*

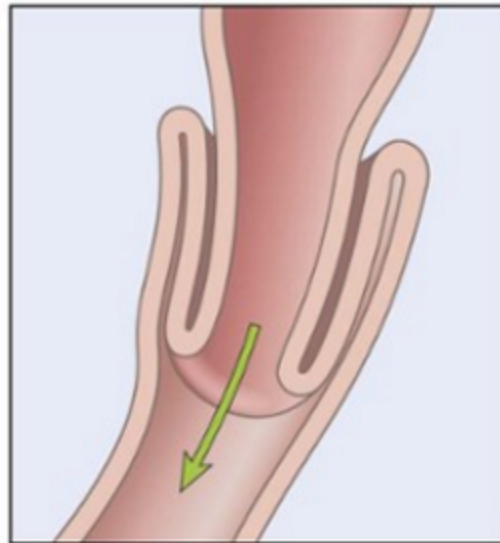
**Herniation**



**Adhesions**



**Volvulus**



**Intussusception**