

# Chronic Diarrhea and malabsorption

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# Definitions

- Diarrhea is defined as a stool volume of greater than 10 cc/kg/day in infants and toddlers and greater than 200 g/day in older children.

**Functionally**, diarrhea should be considered if

- a patient is passing **3 or more unusually loose** stools in a 24-hour period or
- is passing stools **more frequently than usual**, with a **consistency** looser than what is considered normal for that individual.

# pathophysiology

- Diarrhea is further classified by pathophysiology, which typically involves 1 or more of the following mechanisms:
  - (1) osmotic diarrhea,
  - (2) secretory diarrhea
  - (3) altered gastrointestinal tract motility
  - (4) Finally, surgical bowel resection
- Osmotic diarrhea may be related to the **malabsorption** of carbohydrate, fat, or protein or to the presence of nonabsorbable substances in the gastrointestinal lumen.
- **Inflammatory diarrhea** of both infectious and noninfectious etiologies usually involves both osmotic and secretory components.

## TABLE 11.2 Differentiating Osmotic from Secretory Diarrhea

	Osmotic	Secretory
Stool volume	Small (<200 mL/24 hr)	Large (>200 mL/24 hr)
Response to fasting	Diarrhea improves	Diarrhea continues
Stool sodium	<70	>70
Stool osmotic gap*	>50	<50
Stool pH	<5	>6

\*Stool osmotic gap =  $290 - 2 (\text{stool Na}^+ + \text{stool K}^+)$

# Osmotic Diarrhea

## Carbohydrate malabsorption

- Lactose intolerance
- Osmotic laxatives (lactulose, polyethylene glycol 3350)
- Antacids (magnesium hydroxide)
- Ingestion of excessive amounts of non-absorbable sugar or sugar alcohols (sorbitol in chewing gum, diet candy, sucralose)
- Dietary ingestion of excessive fructose
- Disaccharidase deficiency
- short-bowel syndrome

## Fat malabsorption

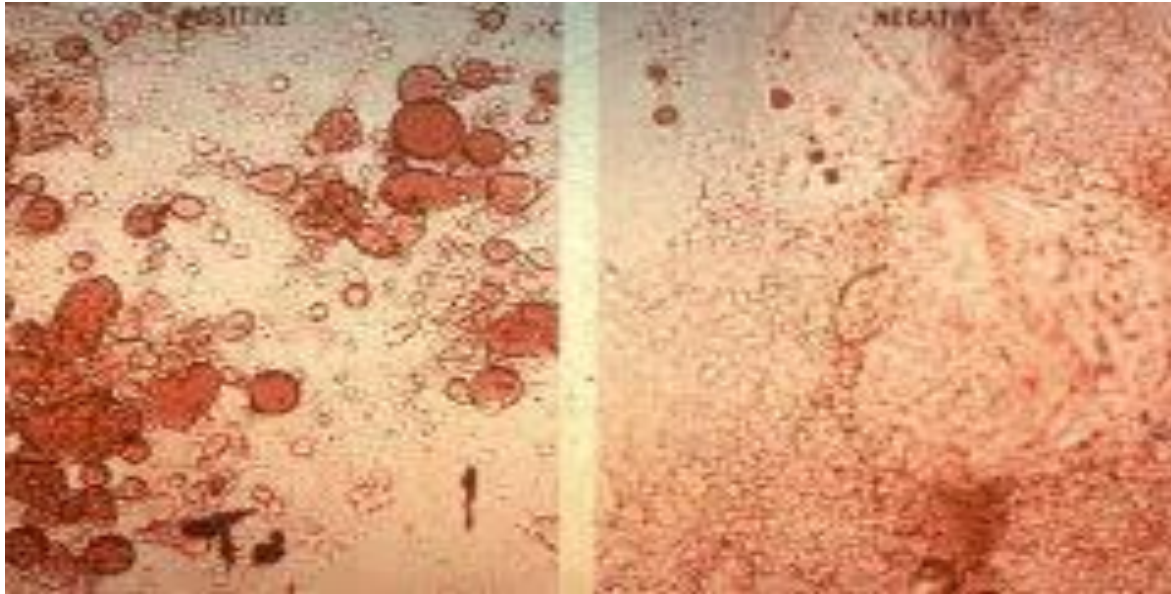
- Pancreatic insufficiency
- Defective handling of bile acids (e.g., primary bile acid malabsorption, cholestasis)
- Defective mucosal lipid handling (e.g., intestinal lymphangiectasia, abetalipoproteinemia, chylomicron retention disease)

## Protein malabsorption

**TABLE 11.3 Distinguishing Isolated Carbohydrate from Isolated Fat Malabsorption**

	<b>Isolated Carbohydrate Malabsorption</b>	<b>Isolated Fat Malabsorption</b>
Stool character	Loose and watery, non-foul-smelling	Bulky large stool, foul-smelling, oil droplets visible
Perianal rash/skin erosion	Present	Present
Signs of fat-soluble vitamin deficiency	Variable	Present
Stool pH	Acidic (usually <6)	Alkaline
Stool reducing/non-reducing substances	Present	Absent

# Fat droplet



# Acute vs. Chronic

- **Acute** diarrhea is usually a self-limited illness that lasts for 2 weeks or less.
- **Chronic diarrhea** persists for more than 2 weeks.
- The etiologies of acute and chronic diarrhea differ by **age**



# Etiology of Chronic diarrhea

## In developing countries:

- acute infections
- malnutrition tends to prolong the course of infectious enterocolitis

## In developed countries:

- functional intestinal disorders,
- nutrient malabsorption (cystic fibrosis),
- celiac disease,
- inflammatory bowel diseases,
- persistent infections of the intestinal tract

# Approach to chronic diarrhea



# History

- the **age** of onset
- the frequency and nature of the stools, including the **presence of blood, nighttime stooling, urgency, weight loss**, and any associated **systemic symptoms**.
- History should also ascertain any **recent travel**, other **sick contacts**,
- A history of **recurrent infections**, use of intravenous drugs (**risk factors for immunodeficiency**)
- **Family history** should be probed for the presence of gastrointestinal disorders or immunodeficiency.

# Physical Examination

- Hydration status
- Growth parameters (age-matched growth charts)
- The physical examination should assess for signs of malnutrition,
- vitamin and micronutrient deficiency,
- dermatologic manifestations of systemic diseases.

# Cont.

- **Jaundice** may suggest hemolysis or hepatic dysfunction.
- Signs of fat-soluble vitamin deficiency:
  - ❑ bone deformities in **vitamin D deficiency**,
  - ❑ dry scaly skin and Bitot spots in **vitamin A deficiency**,
  - ❑ hyporeflexia or gait abnormalities in **vitamin E deficiency**
  - ❑ bruises or bleeding in **vitamin K deficiency**
- Joint examination may reveal arthritis associated with IBD
- **Abdominal examination** (neuroendocrine tumors)
- **perianal examination** may reveal evidence of IBD (fistula, skin tags).





EyeRounds.org

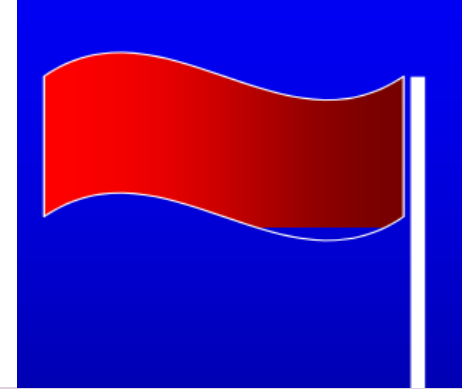


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# Red Flags!!!



Presence of blood in stools

Persistent right upper or right lower quadrant abdominal pain

Involuntary weight loss or growth failure

Delayed puberty

Presence of associated symptoms, such as unexplained fever, suggesting inflammatory arthritides or other systemic diseases

Nocturnal fecal urgency or diarrhea

Perirectal/perianal disease

Persistent dysphagia

# Diagnostic Evaluation

1. diagnostic evaluation suggested by the history and physical examination.
2. **Red Flags**
3. Laboratory investigation should begin with microbiologic studies for bacteria and parasites in the stool.
  - Acute infection with bacteria, such as Yersinia, E. coli, and Salmonella may develop into a chronic illness and can be detected by routine stool cultures
  - C. difficile testing
  - Antigen detection and PCR-based assays for Giardia and Cryptosporidium

## Cont.

- Except in the setting of neonatal-onset diarrhea, **stool electrolytes and osmolality** are of limited use.
- The **differentiation of osmotic and secretory** diarrhea is typically made by a trial of fasting and determining if there is improvement in the stool output
- Stool-reducing substances

## Cont.

- quantifying **fecal fat** and calculating the coefficient of fat absorption, which requires a 72-hour collection of stool.
- Low **fecal elastase** suggests pancreatic insufficiency.
- Elevated levels of **stool alpha-1-antitrypsin (A1AT)**
- Elevated **fecal calprotectin** or fecal lactoferrin are indicative of intestinal inflammation.
- The presence of **fecal leukocytes or occult blood** may indicate mucosal inflammation

# Blood tests

- A **CBC** evaluate for **anemia and thrombocytosis**, which may suggest blood loss and inflammation, respectively.
- microcytosis potentially indicative of iron deficiency or a
- macrocytosis suggestive of vitamin B12 or folate deficiency.
- A normocytic anemia may be seen in chronic inflammatory diseases.
- **White blood cell count and differential** and
- quantification of **immunoglobulins A, G, and M** screen for immune disorders.
- **ESR and CRP** support inflammation but are nonspecific.
- **Low albumin** could be indicative of a chronic inflammatory process or PLE.
- Elevated **anti-tissue transglutaminase immunoglobulin A (IgA) antibody** is sensitive and specific for celiac disease, but a low total serum IgA level may result in a false-negative test.
- **Levels of the fat-soluble vitamins** A, 25-OH vitamin D, vitamin E, and vitamin K (reflected by prothrombin time) may be measured if fat malabsorption is suspected.



# Disorders of Carbohydrate Malabsorption

- The brush border epithelium of the small bowel contains enzymes necessary for carbohydrate digestion.
- **Colonic bacteria** ferment the malabsorbed sugars, which generates a mixture of gases (e.g., hydrogen, methane, and carbon dioxide) and short-chain fatty acids.
- These gases form the basis of carbohydrate-specific **breath hydrogen testing**, which is often used in diagnosis.
- The stools become acidified to a pH of less than 7, which can lead to **diaper dermatitis**.



# Diaper dermatitis



- The classic presentation is severe watery diarrhea, failure to thrive, irritability, and diaper dermatitis

# Secondary lactase deficiency

- **Secondary lactase deficiency** develops when an inflammatory process, such as a **viral infection**, damages the brush border epithelium
- However, the **WHO recommends** avoidance of lactose in children with
- **persistent postinfectious diarrhea lasting more than 14 days.**
- **RS positive**
- **Acidic stool pH**

# CHRONIC NONSPECIFIC DIARRHEA

- Chronic nonspecific diarrhea, also known as **functional** or **toddler's diarrhea**, typically affects children between **1 and 3 years of age** and is characterized by the passage of several watery and unformed stools each day.
- Stools are typically relatively well formed in the morning but become looser as the day progresses. The stools often appear to contain **undigested vegetable** matter but lack blood, mucus, or excessive fat.
- However, in an attempt to treat the diarrhea, many children are placed on restrictive diets

# Small Intestinal Bacterial Overgrowth (SIBO)

- The normal small intestine is colonized with relatively few bacteria, typically less than  $10^4$  organisms/mL.
- Various conditions such as short bowel syndrome, malnutrition, pseudo-obstruction, bowel strictures, and achlorhydria from medications such as proton pump inhibitors may result in overgrowth of aerobic and anaerobic bacteria in the small bowel.
- Symptoms of abdominal pain, bloating, abdominal distention, and diarrhea arise.
- The diagnosis can be made by breath hydrogen testing showing early and late rise in breath hydrogen after ingestion of lactulose.

# Irritable Bowel Syndrome (IBS)

- Irritable bowel syndrome is characterized by **recurrent abdominal pain and altered bowel habits** that typically presents in adolescence.
- Symptoms include abnormal stool **frequency** (either 4 or more stools per day, or 2 or fewer stools per week), abnormal stool **form** (either loose and watery or lumpy and hard), **abnormal passage** of stool (e.g., straining, urgency, feeling of incomplete evacuation), the **passage of mucus, and bloating or distention**



**No Gluten**

# Celiac Disease

- Celiac disease is an immune-mediated systemic disorder elicited by exposure to gluten and related proteins in genetically susceptible individuals
- The pathogenesis of celiac disease first involves exposure to gliadin, .... results in **systemic autoimmunity** and **an inflammatory enteropathy** characterized by:
  1. villous atrophy,
  2. elongated crypts,
  3. intraepithelial lymphocytosis



**Fig. 1.** **a** This is an Indian girl presenting at the age of 3.5 years with chronic diarrhea and severe malnutrition. Investigations showed the positivity of CD serological markers and flat mucosa at the small-intestinal biopsy. **b** After 6 months of gluten-free diet, an impressive improvement of the nutritional status of this child was evident.



# Cont.

## Manifestations include

- recurrent abdominal pain,
- nausea and vomiting,
- iron deficiency with or without anemia,
- short stature,
- aphthous stomatitis,
- chronic fatigue, arthritis,
- raised aminotransferase levels, and
- reduced bone mineral density

# Inflammatory Bowel Disease (IBD)

- Inflammatory bowel disease is divided broadly into ulcerative colitis and Crohn disease, idiopathic systemic chronic inflammatory diseases whose primary symptoms are related to relapsing gastrointestinal tract inflammation.
- Common signs and symptoms include diarrhea, abdominal pain, blood in the stools, and nutritional compromise.

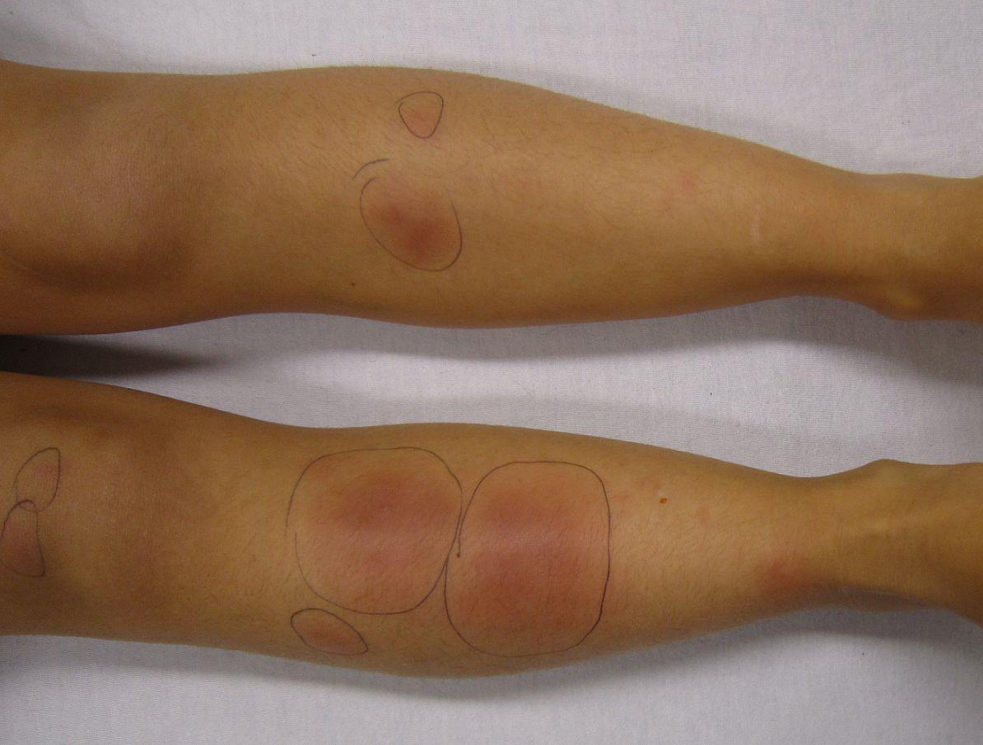
# Clinical presentation.

- Diarrhea with or without blood
- Abdominal pain
- Hematochezia
- Anorexia, weight loss, and fatigue
- Growth failure and pubertal delay
- Abdominal mass
- Fever and night sweats
- Vomiting and nausea
- Extra intestinal manifestations.

- **Oral cavity examination** should look for aphthous ulcers
- **An eye examination** should look for episcleritis, followed by an ophthalmologist to assess for uveitis and keratopathy.
- **A detailed abdominal examination** should document abdominal distention, mass, tenderness and hyper- or hypoactive bowel sounds.
- **assessing the perianal region** for any abscesses or fistulas.
- **Skin examination** should look for erythema nodosum, painful raised red lesions about 1-3 cm in diameter typically found on the shins; pyoderma gangrenosum, a severe ulcerating rash; and psoriatic lesions
- **Two clinical features suggest a diagnosis of Crohn disease over ulcerative colitis:**
  1. **perianal disease**
  2. **presence of structuring and fistulizing disease of the bowel**









## Diagnosis.

- IBD is a clinical diagnosis that integrates **history** and **physical findings** with objective data from **imaging** studies, **laboratory** evaluation, and **endoscopic findings** including **histopathology**

## Important mimics of IBD include

- irritable bowel syndrome,
- Behçet disease,
- infectious enterocolitis (particularly enterovirus and Yersinia),
- tuberculosis

- Congenital diarrhea
- Syndromic diarrhea
- Autoimmune diarrhea

Post test

- شیرخوار 2 ساله با وزن 12 کیلو گرم و اسهال از 3 ماه قبل. به گفته مادر در مدفوع تکه های غذای هضم نشده دیده میشود.
- پسر 1.5 ساله با اسهال آبکی از چند ماه قبل. وزن 5 کیلوگرم است. سابقه جراحی در سه روزگی به دلیل آترزی وسیع ایلئوم
- دختر 11 ساله که به صورت گاهگاهی دچار درد شکم و همزمان اسهال میگردد. در معاینه نکته غیر طبیعی یافت نشد. به گفته مادر همزمان با درد شکمی رنگ پریده میشود.
- دختر 9 ساله با سابقه دفع اسهال آبکی که گاهی رگه های خونی هم دیده میشود از 1 ماه قبل و اختلال رشد قدی و ضایعات قرمز رنگ در ساق پا
- شیرخوار 8 ماهه که از حدود 2 هفته قبل دچار اسهال شده. اسهال در مراحل اولیه همراه با تب بوده ولی اکنون تب ندارد. در ناحیه مقعد اریتم شدید مشاهده میشود.

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# Summery

1. Chronic diarrhea **may be benign**
2. or may signify a **more serious illness** associated with malabsorption, inflammation, or congenital defects.
3. **Red flags** include  
onset of diarrhea in the neonatal period,  
weight loss,  
growth failure,  
anorexia,  
fever,  
fatty stools,  
blood in stools,
4. **extraintestinal manifestations** associated with intestinal disease,
5. **specific nutritional deficiencies** associated with malabsorption.

# Thanks for your attention



Mofid Children's Hospital  
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