

any colonic segment, it develops the greatest wall tension. This may explain the preferential distribution of angiodysplastic lesions in the cecum and right colon. Finally, some data link angiodysplasia with Meckel diverticulum, suggesting the possibility of a developmental component.

Morphologically, angiodysplastic lesions are characterized by ectatic nests of tortuous veins, venules, and capillaries. The vascular channels may be separated from the intestinal lumen by only the vascular wall and a layer of attenuated epithelial cells; limited injury may therefore result in significant bleeding.

## Malabsorption and Diarrhea

**Malabsorption, which presents most commonly as chronic diarrhea, is characterized by defective absorption of fats, fat- and water-soluble vitamins, proteins, carbohydrates, electrolytes and minerals, and water.** Chronic malabsorption can be accompanied by weight loss, anorexia, abdominal distention, borborygmi, and muscle wasting. A hallmark of malabsorption is *steatorrhea*, characterized by excessive fecal fat and bulky, frothy, greasy, yellow or clay-colored stools. The chronic malabsorptive disorders most commonly encountered in the United States are pancreatic insufficiency, celiac disease, and Crohn disease (Table 17-7). Intestinal graft-versus-host disease is an important cause of malabsorption and diarrhea after allogeneic hematopoietic stem cell transplantation.

*Malabsorption results from disturbance in at least one of the four phases of nutrient absorption:*

- *Intraluminal digestion*, in which proteins, carbohydrates, and fats are broken down into forms suitable for absorption;
- *Terminal digestion*, which involves the hydrolysis of carbohydrates and peptides by disaccharidases and peptidases in the brush border of the small intestinal mucosa;
- *Transepithelial transport*, in which nutrients, fluid, and electrolytes are transported across and processed within the small intestinal epithelium; and
- *Lymphatic transport of absorbed lipids*.

In many malabsorptive disorders a defect in one of these processes predominates, but more than one usually contributes. As a result, malabsorption syndromes resemble each other more than they differ. General symptoms include diarrhea (from nutrient malabsorption and excessive intestinal secretion), flatus, abdominal pain, and weight loss. Inadequate absorption of vitamins and minerals can result in anemia and mucositis due to pyridoxine, folate, or vitamin B<sub>12</sub> deficiency; bleeding, due to vitamin K deficiency; osteopenia and tetany due to calcium, magnesium, or vitamin D deficiencies; or peripheral neuropathy due to vitamin A or B<sub>12</sub> deficiencies. A variety of endocrine and skin disturbances may also occur.

*Diarrhea is defined as an increase in stool mass, frequency, or fluidity, typically greater than 200 gm per day.* In severe cases stool volume can exceed 14 L per day and, without fluid resuscitation, result in death. Painful, bloody, small-volume diarrhea is known as *dysentery*. Diarrhea can be classified into four major categories:

- *Secretory diarrhea* is characterized by isotonic stool and persists during fasting.
- *Osmotic diarrhea*, such as that which occurs with lactase deficiency, is due to the excessive osmotic forces exerted by unabsorbed luminal solutes. The diarrhea fluid is more than 50 mOsm more concentrated than plasma and abates with fasting.
- *Malabsorptive diarrhea* follows generalized failure of nutrient absorption, is associated with steatorrhea, and is relieved by fasting.
- *Exudative diarrhea* due to inflammatory disease is characterized by purulent, bloody stools that continue during fasting.

**Table 17-7** Defects in Malabsorptive and Diarrheal Disease

Disease	Intraluminal Digestion	Terminal Digestion	Transepithelial Transport	Lymphatic Transport
Celiac disease		+	+	
Environmental enteropathy		+	+	
Chronic pancreatitis	+			
Cystic fibrosis	+			
Primary bile acid malabsorption	+		+	
Carcinoid syndrome			+	
Autoimmune enteropathy		+	+	
Disaccharidase deficiency		+		
Whipple disease				+
Abetalipoproteinemia			+	
Viral gastroenteritis		+	+	
Bacterial gastroenteritis		+	+	
Parasitic gastroenteritis		+	+	
Inflammatory bowel disease	+	+	+	

+ indicates that the process is abnormal in the disease indicated. Other processes are not affected.