The Gastrointestinal Tract

INTRODUCTION

Although sonography may not always be the modality of choice for the detection of all gastrointestinal abnormalities, it does provide a noninvasive, nonionizing diagnostic instrument. This chapter will provide an overview of gastrointestinal structures often analyzed with sonography. Also, superficial abdominal structures are discussed.

KEY TERMS

acute appendicitis—inflammation of the appendix
adenocarcinoma—cancer originating in glandular tissue
appendicolith—a dense, calcified stone within the appendix
autoimmune disorder—a disorder in which the immune system attacks normal tissue
bezoars—masses of various ingested material that may cause an intestinal obstruction
compression sonography—operator-applied transducer pressure on a structure during a sonographic examination
Crohn disease—an autoimmune disease characterized by periods of inflammation of the gastrointestinal tract
duodenal bulb—the proximal portion of the duodenum closest to the stomach
fecolith—a stone that consists of feces
gastroesophageal junction—the junction between the stomach and the esophagus
gastroesophageal reflux—an abnormality in which fluid is allowed to reflux out of the stomach back into the esophagus
hypertrophic pyloric stenosis—a defect in the relaxation of the pyloric sphincter that leads to the enlargement of the pyloric muscles and closure of the pyloric sphincter
intussusception—the telescoping of one segment of bowel into another; most often the proximal segment of the bowel inserts into the distal segment
intussusception—the proximal segment of the bowel with intussusception
intussusciptens—the distal segment of the bowel with intussusception
invaginate—to insert
lactobezoar—a bezoar that consists of powdered milk
leukocytosis—an elevated white blood cell count
malrotation of the midgut—a situation in which the small bowel mesentery rotates around the superior mesenteric artery
McBurney point—a point halfway between the anterior superior iliac spine and the umbilicus; the area of pain and rebound tenderness in patients suffering from acute appendicitis
mechanical obstruction—a situation in which bowel is physically blocked by something
Meckel diverticulum—a common congenital outpouching of the wall of the small intestine
melanoma—a malignant form of cancer found most often on the skin
nonbilius—not containing bile
nonmechanical obstruction—a situation in which bowel is blocked because of the lack of normal peristalsis of a bowel segment or segments; also referred to as a paralytic ileus
olive sign—when the pyloric sphincter muscle is enlarged and palpable on physical examination of the abdomen; often indicative of pyloric stenosis
paralytic ileus—see key term nonmechanical obstruction
peristalsis—contractions that move in a wavelike pattern to propel a substance
phytobezoars—a bezoar that consists of vegetable matter
pylorospasm—a temporary spasm and thickening of the pyloric sphincter that can replicate the sonographic appearance of pyloric stenosis
rebound tenderness—pain encountered after the removal of pressure; a common clinical finding in patients suffering from acute appendicitis
red currant jelly stool—feces that contains a mixture of mucus and blood; a common clinical finding in patients suffering from intussusception
TABLE 10-1  The Layers of the Gut Identified with Sonography and Their Associated Echogenicities

<table>
<thead>
<tr>
<th>Layers of Gut Identified with Sonography</th>
<th>Echogenicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial mucosa (innermost layer)</td>
<td>Echogenic</td>
</tr>
<tr>
<td>Deep mucosa</td>
<td>Hypoechoic</td>
</tr>
<tr>
<td>Submucosa (muscularis propria interface)</td>
<td>Echogenic</td>
</tr>
<tr>
<td>Muscularis propria</td>
<td>Hypoechoic</td>
</tr>
<tr>
<td>Serosa (outermost layer)</td>
<td>Echogenic</td>
</tr>
</tbody>
</table>


Anatomy of the Gastrointestinal Tract

The gastrointestinal tract, or alimentary canal, consists of the mouth, pharynx, esophagus, stomach, the small intestines, and colon. The mouth is the most proximal portion of the gastrointestinal tract. The pharynx lies distal to the mouth and unites it to the esophagus. The esophagus travels inferiorly within the thorax and through an opening in the diaphragm called the esophageal hiatus. The distal esophagus attaches to the stomach. This area, the gastroesophageal junction, can be identified with sonography.

The stomach consists of a fundus, body, and pyloric region. Within the distal stomach lies the pyloric sphincter, a muscle that controls the emptying of the contents of the stomach into the duodenum. The proximal duodenum is C-shaped, and thus it is referred to as the C-loop of the duodenum. Distal to the duodenum are the jejunum and ileum of the small intestines. The ileum meets the cecum, or proximal colon, at the ileocecal valve within the right lower quadrant of the abdomen. At this level, a blind-ended tube, the vermiform appendix, is connected to the cecum.

After the cecum, the colon is termed the ascending colon as it travels superiorly toward the liver. A bend in the colon, the hepatic flexure, marks the beginning of the transverse colon, which travels across the abdomen. Another bend, the splenic flexure, located inferior to the spleen, marks the beginning of the descending colon. The colon travels inferiorly and becomes the sigmoid colon and subsequently the rectum. The anus, the external opening of the rectum, marks the termination point of the alimentary canal. Most gastrointestinal tract parts are considered intraperitoneal, with the exception of the duodenum and ascending and descending colon, which are regarded as retroperitoneal in location.

Sonography of the Gastrointestinal Tract

Sonography of the gastrointestinal tract may be indicated in the setting of several clinical conditions, including hypertrophic pyloric stenosis, intussusception, and acute appendicitis. Most gastrointestinal tract sonographic studies are performed using a high-frequency linear array transducer, although some studies may require a curved array transducer. During the examination, normal “gut signature” should be noted with sonography. The gastrointestinal tract consists of five histologic layers that sonographically appear as alternating echogenic and hypoechoic segments (Table 10-1). However, not all of these are consistently identified with sonography. The alternating echogenicities of the bowel wall layers should produce the classic “target” or “bull’s-eye” appearance.

A sonographic examination of the gastrointestinal tract should include graded-compression or compression sonography to differentiate normal from anomalous bowel. Specifically, normal bowel should be compressible and should have observable peristalsis. Compression of the bowel will also move intraluminal fluid and/or gas out of the area of interest. Also, the wall of the involved bowel segment(s) should be closely analyzed. In general, the normal intestinal wall should measure less than 5 mm in thickness. A normal bowel wall segment produces little to no color Doppler. Consequently, color Doppler can be beneficial, as inflammatory changes and neoplasms within the gastrointestinal tract will often reveal evidence of hyperemia. Additionally, transvaginal imaging has proven to be useful in identifying the inflamed appendix in some women, and may also prove valuable for analyzing the rectum and sigmoid colon for irregularities. Although rarely used, a water enema technique can be integrated during the examination to assess the rectum and sigmoid colon for suspected pathology.
GASTROINTESTINAL PATHOLOGY

Acute Appendicitis

The appendix, or vermiform appendix, is a long, narrow, blind-ended tube. Although its location may be variable, it is commonly located within the right lower quadrant, at the level of the cecum. Appendicitis, inflammation of the appendix, has been cited as the most common cause of acute abdominal pain resulting in surgery.1,6

Acute appendicitis may be the result of some form of obstructive process such as an appendicolith, fecolith, lymph node, tumor, foreign body, seeds, or parasite.1,7 Clinically, patients may present with a history of epigastric pain, periumbilical pain, or general abdominal pain that, with time, is confined to the right lower quadrant. Patients will also suffer from rebound tenderness over the McBurney point in the right lower quadrant. Therefore, if possible, it is helpful to have the patient point to the most painful region. Laboratory tests, such as white blood cell count, are helpful as well, as many patients with acute appendicitis will have evidence of leukocytosis.

Graded compression is used to sonographically investigate the abdomen for signs of appendicitis. The inflamed appendix will appear as a noncompressible, blind-ended tube that measures more than 6 mm in diameter (Fig. 10-1).2 This measurement is taken from outer wall to outer wall.7 Careful exploration is further warranted for the presence of an obstructive etiology such as an appendicolith. An appendicolith will appear as an echogenic, shadowing structure within the lumen of the appendix (Fig. 10-2). There may also be evidence of a periappendiceal fluid collection, fat stranding around the appendix, and hyperemic flow within the wall of the irritated appendix. Complications of appendicitis include perforation, peritonitis, abscess formation, and possibly even death.7 A normal appendix may be perceived sonographically, and therefore, a comprehensive assessment, which includes both clinical findings and sonographic criteria, should be executed.

Clinical Findings of Acute Appendicitis

1. Initial epigastric or general abdominal pain that, with time, is confined to the right lower quadrant
2. Acute abdominal pain
3. Rebound tenderness
4. Nausea and vomiting
5. Possible leukocytosis
6. High fever (with abscess formation)
Hypertrophic Pyloric Stenosis

The pylorus is the distal region of the stomach. The pyloric channel is located at the distal portion of the pylorus, between the stomach and the proximal duodenal bulb. In this region, a group of muscles, called the pyloric sphincter, controls gastric emptying and prevents undigested food products, or chyme, from refluxing back into the stomach from the duodenum. Hypertrophic pyloric stenosis (HPS) is a defect in the relaxation of the pyloric sphincter. This leads to the enlargement, or hypertrophy, of the pyloric muscles, effectively causing a persistent closure of the pyloric sphincter.

Although HPS can occur in adults, it is most commonly encountered in infants between 2 and 8 weeks old. First-born male infants are more likely to suffer from HPS. The patient with HPS often presents clinically with nonbilious, projectile vomiting, dehydration, weight loss, constipation, and an insatiable appetite. The enlarged pyloric muscle may be palpable during a physical examination of an infant with pyloric stenosis. This is referred to as the "olive" sign.

In the past, the customary diagnostic modality used to evaluate infants with clinical findings consistent with pyloric stenosis was radiography. Now, sonography has become the modality of choice. To examine the pyloric region of the stomach, the infant is placed in the right lateral decubitus position. If the stomach is completely empty, a small amount of water or glucose solution may be given to the infant to drink to better visualize the pylorus. In the longitudinal plane, the pylorus will be noted within the epigastrium, slightly right of the midline, near the gallbladder. The pylorus is normally positioned transversely in the abdomen. Therefore, the abnormal pylorus appears as a "target" or "doughnut" in the longitudinal scan plane of the abdomen and as a cervix ("cervix sign") in the transverse scan plane of the abdomen (Figs. 10-3 and 10-4). If pyloric stenosis is present, the wall of the pyloric muscle will measure 3 mm or greater in thickness, while the length of the abnormal pyloric channel will measure 17 mm or greater. It is important to note that the thickness of the muscle appears to be the more specific sonographic measurement. Furthermore, fluid must be observed traveling from the pylorus into the duodenum to eliminate the diagnosis of pyloric stenosis.

Three additional causes of nonbilious vomiting in the infant are pylorospasm, gastroesophageal reflux, and malrotation of the midgut. These abnormalities should be excluded in those patients who present with clinical findings consistent with pyloric stenosis.

Pylorospasm is a common cause of delayed gastric opening as well. Unlike HPS, the measurements tend to be within normal limits, and eventually, during follow-up examinations some fluid is noted traveling through the pyloric channel. Gastroesophageal reflux is another cause of nonbilious projectile vomiting in the infant. A transverse section of the gastroesophageal junction can be seen in most persons posterior to the left lobe of the liver and anterior to the abdominal aorta in the sagittal scan plane of the abdomen. After identifying the gastroesophageal junction, the transducer is manipulated to obtain a longitudinal image of the esophagus. Fluid mixed with gas bubbles can be observed traveling retrograde up the esophagus in cases of gastroesophageal reflux.
Malrotation of the midgut, with or without volvulus, has a presentation that is clinically similar to that of HPS. With malrotation, the small bowel mesentery rotates around the superior mesenteric artery (SMA). The sonographic diagnosis of malrotation is confirmed by identifying the relationship of the SMA with the superior mesenteric vein (SMV). The SMA is typically located to the left of the SMV. With malrotation, the two vessels will be reversed. An upper gastrointestinal radiographic series is typically used to verify the diagnosis of malrotation.

**Clinical Findings of Pyloric Stenosis**
1. First-born male infant
2. Nonbilious, projectile vomiting
3. Weight loss
4. Constipation
5. Dehydration
6. Insatiable appetite
7. Palpable olive sign

**Sonographic Findings of Pyloric Stenosis**
1. Abnormal pylorus appears as a target or doughnut in the transverse view
2. Abnormal pylorus appears as a cervix in the longitudinal view
3. Wall of pylorus will measure greater than or equal to 3 mm in thickness
4. Length of pyloric channel will measure greater than or equal to 17 mm

**Intussusception**

Sonography has become the modality of choice for evaluating pediatric patients with clinical symptoms suggestive of intussusception. Intussusception is the telescoping of one segment of bowel into another. Specifically, the intussusceptum, the proximal portion of the bowel, is allowed to invaginate into the next distal segment, the intussuscipiens. The most common type of intussusception, the ileocolic intussusception, occurs within the right lower quadrant at the level of the ileocecal valve. Intussusception occurs more often in male patients, and it has been cited as the most common cause of intestinal obstructions in children less than 2 years of age. Conversely, it rarely occurs in those under 3 months and over 3 years of age. In patients older than 2 years, a lead point to the mass should be established. This lead point may be an intestinal polyp or Meckel diverticulum.

Clinically, patients present with intermittent, severe abdominal pain, vomiting, and a palpable abdominal mass. Their stool often contains a mixture of blood and mucus. This is referred to as a red currant jelly stool, and it is a hallmark clinical finding of intussusception. Laboratory tests may reveal anemia, dehydration, and/or leukocytosis as well.

Graded-compression sonography should be used to evaluate the pediatric patient who has clinical findings suspicious for intussusception. With sonography, an intussusception will appear as a “target” mass in the transverse plane or a “pseudokidney” in the longitudinal plane to the mass (Fig. 10-5). The intussusception will have alternating rings of echogenicity representing the edematous layers of the bowel wall. The abnormal bowel in this area will be noncompressible.

This condition can lead to ischemia and gangrene of the bowel. Consequently, color Doppler may be utilized to determine if blood flow is present within the intussusception. Flow should be present within the bowel wall with higher gain settings. Treatment for intussusception is by means of an air or contrast enema. If gangrene is suspected, surgical intervention is warranted.

**Clinical Findings of Intussusception**
1. Intermittent, severe abdominal pain
2. Vomiting
3. Palpable abdominal mass
4. Red currant jelly stools
5. Leukocytosis
SECTION 1 | ABDOMINAL SONOGRAPHY REVIEW

Intestinal Obstruction

An intestinal obstruction may be incidentally noted during a sonographic examination of the abdomen. There are two types of intestinal obstructions: mechanical and nonmechanical. A *mechanical obstruction* results from the bowel being physically blocked by something. A *nonmechanical obstruction* or *paralytic ileus* is when the bowel lacks normal peristalsis. Sonographically, an intestinal obstruction appears as distended fluid-filled loops of bowel. Occasionally, an abrupt termination point of the distended bowel may be identified with sonography, although bowel gas may inhibit this finding. Peristaltic motion may also be increased in cases of mechanical obstruction, with signs of to-and-fro motion of the intraluminal contents.

Although rarely identified sonographically, masses of various ingested material may cause intestinal obstructions. These are referred to as *bezoars*. Bezoars that are more often found in pediatric patients, *trichobezoars*, consist of ingested hair. Pediatric patients may also suffer from *lactochezoars*, which are bezoars that consist of powdered milk that has not been adequately mixed with water. Bezoars that consist of vegetable material are called *phytobezoars* and are more often found in older patients. Sonographically, bezoars will appear as complex masses with varying degrees of acoustic enhancement and posterior shadowing, depending on their structure.

### Sonographic Findings of Intussusception

1. Noncompressible, target-shaped or pseudokidney-shaped mass that consists of alternating rings of echogenicity

### Clinical Findings of Crohn Disease

1. Episodes of diarrhea
2. Abdominal pain
3. Weight loss
4. Rectal bleeding

### Sonographic Findings of Crohn Disease

1. Bowel wall thickening
2. Affected bowel will be noncompressible and have a target appearance
3. Hyperemic wall

### Gastric Carcinoma and Metastatic Disease of the Bowel

Gastric cancer is most often in the form of *adenocarcinoma*. Patients typically present with weight loss, abdominal pain, anorexia, and vomiting. Occasionally, gastric carcinoma may be identified with sonography. Most often, a malignancy of the alimentary tract will appear as a hypoechoic, irregular-shaped, bulky mass that can measure up to 10 cm in size. The mass may have a “target” or “pseudokidney” appearance as well. Malignant melanoma and primary tumors of the lungs and breast are the most commonly encountered metastatic tumors. Their sonographic appearance may be similar to that of primary adenocarcinoma.

### Clinical Findings of Gastric Carcinoma

1. Weight loss
2. Abdominal pain
3. Anorexia
4. Vomiting

### Sonographic Findings of Gastric Carcinoma

1. Hypoechoic, irregular-shaped, bulky mass

### Anterior Abdominal Wall Pathology

Rectus Sheath Hematoma

The rectus sheath forms a covering for the paired rectus abdominis muscles. The rectus abdominis muscles are found on both sides of the midline of the
anterior abdomen. They are divided by a band of connective tissue, the linea alba, which is located in the midline of the abdomen. A rupture in the muscle or associated vasculature can lead to a rectus sheath hematoma. Blood accumulation within the muscle or under the sheath can be the result of abdominal trauma or may occur spontaneously. Abdominal contractions that result from child birth, sneezing, coughing, defecation, urination, and intercourse have been shown to result in a rectus sheath hematoma. Clinically, patients present with abdominal pain, palpable abdominal mass, discoloration of the skin in the area of the hematoma, and a decreased hematocrit. Sonographically, a rectus sheath hematoma can appear anechoic, hypoechoic, complex, or hyperechoic depending on the stage of development.

**Clinical Findings of a Rectus Sheath Hematoma**

1. Abdominal pain
2. Palpable abdominal mass
3. Discoloration of the skin in the area of the hematoma
4. Decreased hematocrit

**Sonographic Findings of a Rectus Sheath Hematoma**

Blood can appear hypoechoic, hyperechoic, complex, and/or anechoic depending on the stage of development.

**Abdominal Wall Hernias**

The abdominal wall can be sonographically interrogated for various abdominal wall hernias. There are several different types of hernias (Table 10-2). Inguinal hernias are further discussed in Chapter 13. A high-frequency linear transducer and standoff pad should be utilized during the examination. Sonography of abdominal wall hernias can be difficult. Often, the Valsalva technique is utilized to show movement and the change in size of the hernia. Hernias should be carefully examined for bowel content and peristaltic motion of that bowel. Abdominal wall hernias can have different sonographic appearances because the contents of the hernia can vary. Complications of abdominal wall hernias include incarceration, strangulation, and ischemia of the affected bowel.

**Table 10-2** Types of Abdominal Hernias

<table>
<thead>
<tr>
<th>Type of Hernia</th>
<th>Description</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inguinal hernia</td>
<td>Can be further described as direct or indirect</td>
<td>Groin</td>
</tr>
<tr>
<td>Incisional hernia</td>
<td>Bowel protrudes into a surgical incision site</td>
<td>A surgical incision site</td>
</tr>
<tr>
<td>Linea alba hernia</td>
<td>Bowel protrudes through the fascia of the linea alba</td>
<td>Midline of the abdomen</td>
</tr>
<tr>
<td>Umbilical hernia</td>
<td>Bowel protrudes into the umbilicus</td>
<td>Umbilicus</td>
</tr>
<tr>
<td>Spigelian hernia</td>
<td>Bowel protrudes into a weakened area in the lower one fourth of the rectus muscle</td>
<td>Midline of the abdomen Between the umbilicus and symphysis pubis</td>
</tr>
</tbody>
</table>

**Review Questions**

1. Which of the following is not a layer of gut identified with sonography?
   a. Visceral
   b. Serosa
   c. Submucosa
   d. Mucosa

2. All of the following are true of normal intestinal findings with sonography except:
   a. Normal bowel does not compress
   b. Normal bowel should have observable peristalsis
   c. Intestinal wall should measure less than 5 mm
   d. Normal bowel has little to no color Doppler signals
3. All of the following are sonographic criteria in the diagnosis of pyloric stenosis except:
   a. Wall of the pylorus measures less than 8 mm
   b. Length of the pylorus measures more than 17 mm
   c. Doughnut appearance in transverse
d. Cervix appearance in longitudinal

4. All of the following are sonographic findings of acute appendicitis except:
   a. Appendicolith
   b. Compressible, blind-ended tube
c. Periappendiceal fluid collection
d. Hyperemic flow

5. Clinical findings of acute appendicitis include all of the following except:
   a. Leukocytosis
   b. Right lower quadrant pain
c. Constipation
d. Rebound tenderness

6. All of the following are common clinical findings in infants that present with pyloric stenosis except:
   a. Weight loss
   b. Dehydration
c. Olive sign
d. First-born female

7. Red currant jelly stools are associated with what abnormality?
   a. Diverticulosis
   b. Appendicitis
c. Intussusception
d. Pyloric stenosis

8. Other abnormalities that can present much like pyloric stenosis include all of the following except:
   a. Midgut malrotation
   b. Pylorospasm
c. Gastroesophageal reflux disease
d. Intussusception

9. Gastric cancer is most often in the form of:
   a. Cystadenocarcinoma
   b. Adenocarcinoma
c. Rhabdomyosarcoma
d. Angiosarcoma

10. Pediatric patients could suffer from bowel obstructions that are caused by a buildup of ingested hair. The mass associated with this type of obstruction is termed a:
    a. Phytobezoar
    b. Lactobezoar
c. Trichobezoar
d. Permabezoar

11. An autoimmune disease characterized by periods of inflammation of the gastrointestinal tract describes:
    a. Crohn disease
    b. Intussusception
c. Pyloric stenosis
d. Meckel diverticulitis

12. The telescoping of one segment of bowel into another is referred to as:
    a. Volvulus
    b. Crohn disease
c. Intussusception
d. Pyloric stenosis

13. What gastrointestinal abnormality is sonographically diagnosed as an abnormal relationship between the superior mesenteric artery and superior mesenteric vein?
    a. Pyloric stenosis
    b. Intussusception
c. Crohn disease
d. Midgut malrotation

14. The situation when bowel protrudes into the groin is referred to as:
    a. Inguinal hernia
    b. Linea alba hernia
c. Umbilical hernia
d. Spigelian hernia

15. The situation when bowel protrudes into a weakened area in the lower one fourth of the rectus muscle is referred to as:
    a. Inguinal hernia
    b. Linea alba hernia
c. Umbilical hernia
d. Spigelian hernia

16. The area of pain and rebound tenderness with acute appendicitis is most likely at:
    a. Meckel point
    b. McBurney point
c. Murphy point
d. Olive point

17. Which of the following best describes the location of the area mentioned in question 16?
    a. Left lateral to the umbilicus and medial to the left iliac crest
    b. Halfway between the anterior superior iliac spine and the umbilicus
18. The olive sign is best described as:
   a. The palpation of the inflamed appendix with rebound tenderness
   b. An area of pain halfway between the anterior superior iliac spine and the umbilicus
   c. An enlarged palpable pyloric sphincter
   d. The sonographic appearance of pyloric stenosis

19. Rebound tenderness is associated with:
   a. Appendicitis
   b. Intussusception
   c. Diverticulitis
   d. Gastric carcinoma

20. The most common location of the vermiform appendix is in the area of the:
   a. Jejunum
   b. Descending colon
   c. Cecum
   d. Sigmoid colon

21. Which of the following is not associated with a rectus sheath hematoma?
   a. Palpable abdominal mass
   b. Increased hematocrit
   c. Child birth
   d. Sneezing

22. Which of the following is not a sonographic finding consistent with Crohn disease?
   a. Bowel wall thickening
   b. Noncompressible bowel that has a target appearance
   c. Increased peristalsis
   d. Hyperemic wall

23. All of the following are common clinical findings in infants that present with intussusception except:
   a. Vomiting
   b. First-born male infant
   c. Red currant jelly stools
   d. Leukocytosis

24. The sonographic finding of fluid-filled, distended loops of bowel is consistent with:
   a. Meckel diverticulum
   b. Diverticulitis
   c. Gastroesophageal reflux disease
   d. Intestinal obstruction

25. Traditionally, treatment for intussusception is by means of:
   a. Surgery
   b. External manipulation
   c. Compression sonography
   d. Contrast enema

26. The most common cause of intestinal obstruction in children less than 2 years of age is:
   a. Intussusception
   b. Midgut malrotation
   c. Pyloric stenosis
   d. Acute appendicitis

27. Hypertrophic pyloric stenosis is most often found in infants between:
   a. 1 and 10 days of age
   b. 2 and 8 weeks of age
   c. 10 and 24 weeks of age
   d. 2 and 4 years of age

28. For better sonographic visualization of the pyloric sphincter, the infant is often placed in what position?
   a. Right lateral decubitus
   b. Left lateral decubitus
   c. Prone
   d. Upright

29. What are the diagnostic criteria for pyloric stenosis?
   a. 17 mm in thickness and 2 mm in length
   b. 17 mm in thickness and 3 mm in length
   c. 3 mm in thickness and 10 mm in length
   d. 3 mm in thickness and 17 mm in length

30. Clinical findings of a patient with Crohn disease include all of following except:
   a. Palpable abdominal mass
   b. Rectal bleeding
   c. Abdominal pain
   d. Weight loss

REFERENCES


