Diagnostic Approach to Colic in Adult Horses:

The described approach to colic workup is based on the "10 P's" of Dr. Al Merritt.

1. PAIN – degree, duration, and type

2. PULSE – rate and character

3. PERFUSION – mucous membranes, skin tent, jugular fill, etc.

4. PERISTALSIS – gut sounds, fecal production

5. PINGS – simultaneous auscultation/percussion

6. PASSING A TUBE – amount and character of reflux, if present

7. PALPATION – rectal exam

8. PAUNCH – a word for obvious abdominal distention that begins with "P"

9. PCV/TP

10. PERITONEAL FLUID

PHYSICAL EXAMINATION:

1. PAIN

One should consider the severity and duration of pain, as well as the animal's response to analgesic medication. As part of the history, it is important to ascertain the quantity and type of medication administered by the owner prior to your arrival. Generally, continuous pain which is not responsive to analgesics more likely originates from a surgical lesion. The one caveat to this is moderate to severe pain which is relieved by gastric decompression, suggestive of proximal enteritis or moderate pain in horses with ileal impaction.

Those few horses that continue to exhibit violent signs of pain (ie. throwing themselves down, violently rolling, etc. – not just pawing or lying quietly) despite NSAID therapy and increasing amounts of sedation generally have a surgical lesion and necessitate PROMPT referral. Truly, pain is one of the most important clinical signs when differentiating between surgical and medical causes of colic and, along with cardiovascular status, indication for referral.

Intermittent pain is usually not as serious, though it clearly does not preclude diagnosis of a surgical lesion. Many horses with large colon displacements, and some with strangulation of a small piece of small intestine, will display only moderate but persistent signs of pain. The abrupt cessation of pain followed by clinical signs of shock should raise the concern of intestinal rupture causing Septic Peritonitis (swift death).

2 & 3. PULSE and PERFUSION

Cardiovascular status is another telling indicator of the need for referral and, along with pain, one of the primary indications for surgery. Moderate (>50) to marked (>80) tachycardia should always raise concern and heighten one's sense of urgency during an examination. Always repeat the heart rate in a few minutes, especially if the horse has just been moved in/out from a field or stall, or if it has just come off the van after transport. A heart rate consistently 50 or greater should raise concern in any horse.

Endotoxemia can contribute to tachycardia as well as poor systemic perfusion. Toxic horses will often have darker pink, progressive to purple, mucous membranes.

Alternatively, horses with simple dehydration will often have pink to pale pink membranes which are dry or tacky to the touch, often with a delayed CRT.

4 & 5. Abdominal auscultation (PERISTALSIS and PINGS)

These should be considered together during abdominal auscultation. The frequency, intensity, and duration of sounds should be considered and characterized for each quadrant of the abdomen. But, be careful not to read too much into these findings. Horses with strangulating lesions can have normal or increased borborygmic early in the course of disease.

A complete absence of gut sounds or the presence of only short, muffled sounds often indicates ileus, but will not be specific as to cause. In general, an absence of intestinal noises is more significant than the presence of sounds in evaluating the horse with the acute abdomen, and it usually implies significant disease. An absence of gastrointestinal sounds may be caused by administration of a sedative, or it may imply that surgery is needed.

The reappearance of gut sounds after a previous absence should be considered as a positive finding. It is important to listen for several minutes to allow a full cycle of contractions of the bowel to occur. Increased abdominal sounds may be heard in horses with impending colitis or enteritis.

In cases with marked large intestinal distention but not a surgical option, pings can be used to identify a location for enterocentesis (i.e. cecal trocharization).

The presence of sand within the gastrointestinal tract may be determined by listening to the ventral abdominal wall caudal to the xiphoid process and are similar to the sounds heard when listening to a seashell.

Gas pockets and tympany may be localized by simultaneous auscultation and percussion. Areas of tympany are more reliably located in the right paralumbar fossa, where the cecum and colon are in direct contact with the body wall.

Auscultation of the thorax is important to rule out thoracic disease in horses that are exhibiting signs of colic. Colic may be suspected in horses with bronchopneumonia. Pleural effusion can be detected by auscultation, but in horses with colic, the heart sounds radiate over a larger area than is typical and decreased lung sounds are heard ventrally.

Another indicator of peristalsis is fecal production and time to appearance of mineral oil (normally 12-24 hours after administration). If feces are present, either on the ground or in the rectum upon palpation, one can perform a "sand test" by inverting the feces in a rectal sleeve and adding water. While a negative sand test does not rule out sand as a component of an impaction, a positive one certainly supports it.

6. PASSING A TUBE

Nasogastric intubation should be performed on all horses presented for colic.

If an animal has moderate to marked tachycardia or moderate to severe signs of pain, passage of a nasogastric tube should be performed early in the examination process. A horse showing signs of colic with a heart rate >60 beats/min should have a nasogastric tube passed immediately because tachycardia can be an indication of gastric distention and pending fatal gastric rupture. When there is gastric dilation (either primary or secondary), Nasogastric intubation may prevent gastric rupture and save the life of the horse. However, complications include haemorrhage, tracheal intubation, pharyngeal and esophageal trauma.

Large-bore stomach tubes facilitate recovery of gastric fluid because they are less likely to become occluded by gastric contents than are smaller tubes. Stomach tubes are routinely left in place during anesthesia for colic surgery to facilitate gastric decompression and decrease uncontrolled gastric reflux (which can cause pharyngeal burns or pneumonia if aspirated).

Flushing of fluid into the nasogastric tube can start a siphoning action to empty the stomach. Effective emptying of the stomach can be verified by ultrasonography or gastroscopy.

If a significant amount of reflux is obtained, it may well have been a life-saving procedure. Otherwise, the tube can always be left in place for the remainder of the exam for subsequent administration of enteral therapy, if necessary.

If reflux is obtained, one should consider both the amount and character of the fluid obtained. In animals with suspected proximal enteritis, additional testing for Clostridium or Salmonella can be performed. Repeated large volumes of gastric reflux suggest ileus of at least the proximal small intestine.

7. RECTAL PALPATION

Findings from rectal palpation can often provide very useful diagnostic and prognostic (especially surgical vs. medical) information. However, a normal rectal examination does not imply the absence of serious disease.

Abnormalities noted on abdominal palpation per rectum can include distended or edematous small intestine, small intestinal impactions, large colon distention, impaction or edema, displacements of the large colon, space-occupying masses (abscesses, neoplasia), abnormalities of the urogenital tract (uterine torsion or hemorrhage into the broad ligament), inguinal herniation, and free abdominal gas

associated with visceral rupture. Enteroliths are rarely felt because of their location in the transverse colon or proximal small colon, but hay is occasionally found.

Other things to consider:

- Small intestine is usually not palpable in the normal horse.
- Failure to locate the pelvic flexure is not uncommon in normal horses.
- Mild to moderately distended loops of small intestine may signify duodenitis/proximal jejunitis, whereas larger, more tightly distended loops may indicate a strangulating lesion or an ileal impaction. But, this distinction is rarely straightforward. Ultrasonographic assessment can be extremely helpful.
- With left dorsal displacement (nephrosplenic entrapment), one can palpate the colon as it passes over the ligament, immediately lateral to the caudal pole of the left kidney. The character of the colon can vary, depending upon the degree of distention. If the colon is located high on the left side, but not definitively over the ligament, it probably isn't truly entrapped.
- Gas-distended large colon is just that. Rectal findings, in conjunction with clinical findings, can be suggestive of right dorsal displacement of the large colon. But, many horses with suspected displacement can resolve with medical therapy –tough to say if they were truly displaced or just distended; probably the latter.
- ALWAYS sweep the inguinal rings. Small intestine entering the ring is indicative of inguinal hernia.
- In a pregnant mare, the body of the uterus should be carefully palpated for any evidence of uterine torsion which is usually cranial to the cervix. Volvulus is most common in broodmare post foaling as the previously large uterus suddenly reduces after birth leaving a space for volvulus of colon.
- A firm mass in the abdomen (intussusception, abscess, lipoma, or intramural lesion) or within the intestinal lumen (enterolith or impaction) can provide an immediate diagnosis (or at least a short list of differentials).
- Palpation of gritty serosal surfaces or serosal crepitus is highly suggestive of a ruptured viscus.
- Small colon impactions frequently result in an edematous, sometimes gritty rectum. This can also cause some serosanguinous discharge.

The most important thing to consider when performing a rectal examination is the safety of both patient and veterinarian. Risk factors for rectal tears include: small size, male sex, Arabian breed, colic, inadequate restraint, excessive straining, and inadequate lubrication. Thus, always use plenty of lube, have a competent handler, and use ample sedation and/or a twitch. If an animal combines several risk factors (ie. a 375 kg Arab stallion presented for colic), always take care to make the procedure as safe as possible. Complications include rectal tears.

Buscopan (0.1-0.3 mg/kg IV) will greatly improve the rectal exam due to its antispasmodic effects. Just remember that it also causes a significant, transient tachycardia. A lidocaine enema (15-60 ml of 2% lidocaine, q/s to 60 ml total volume) can also facilitate the procedure by increasing rectal compliance. The rectal sleeve should be well lubricated. Sodium carboxymethylcellulose is the most common lubricant used (e.g., 200–500 mL) and should be applied liberally to the arm and reapplied as necessary.

Attention should be paid to the volume and consistency of faeces in the rectum. In a normal horse, there should be several large handfuls of formed faecal balls in the rectum. Faeces, however, should not be impacted in the rectum. Time should be taken to completely evacuate the rectum of faeces prior to beginning the examination. Topical lidocaine can be applied once the rectum is emptied of faeces. Reapplication of lubrication to the examiner's hand and arm several times throughout the procedure is often necessary. The palpation is performed with the fingers together and the hand in a long, narrow formation (fist formation and spreading the fingers apart should be avoided). The examiner's arm is eventually inserted all the way into the horse's rectum to the level of the shoulder. The examiner should allow the arm to move caudally with rectal peristalsis and should never force the arm in a cranial direction against peristalsis. The rectal mucosa is often redundant, and the cranial rectum and distal small colon curve usually to the left and in a ventral direction. Care should be taken to gently navigate the hand through these obstacles and attain a position whereby the abdominal contents can be examined.

Table 3.2 Abdominal structures that can and cannot be palpated in the normal horse.

Palpable structures	Nonpalpable structures
• Ventral band of the cecum	• Stomach and pylorus
• Great vessels	• Duodenum*
• Caudal pole of left kidney	• Jejunum*
• Caudodorsal aspect of spleen	• Ileum*
• Nephrosplenic space ± ligament	• Right dorsal[1] and ventral colon
• Fecal balls in small colon	• Sternal and diaphragmatic flexure of colon
• Uterus and ovaries (mare)	• Transverse colon
• Inguinal rings (stallion)	• Proximal small colon
• Bladder when distended with urine	• Liver
	• Right kidney
	• Mesenteric root*

*Structures that may be palpated when abnormal.

Table 3.4 Diagnoses that can be made on palpation per rectum.

Anatomical location	Diagnosis
Small intestine	• Ileal impaction (p. 208) • Inguinal hernia (p. 284)
Cecum	• Cecal impaction (p. 214) • Cecal tympany
Large colon	• Pelvic flexure impaction (p. 217) • Right dorsal colon impaction (rarely) (p. 217) • Nephrosplenic ligament entrapment (p. 219)
Small colon	• Small colon impaction (p. 221) • Enterolithiasis (rarely) (p. 218)
Rectum	• Rectal tear (p. 36) • Perirectal abscess (p. 138)

Table 3.3 Abnormal findings on palpation per rectum and some associated differential diagnoses.

| Anatomical location	Abnormal finding	Differential diagnoses
Small intestine	A single loop or multiple loops of distended small intestine palpated throughout the abdomen	• Proximal enteritis (p. 207) • Ileus (p. 251) • Epiploic foramen entrapment (p. 211) • Strangulating lipoma (p. 209) • Inguinal hernia (p. 286) • Jejunal volvulus (p. 212) • Jejunal intussusception (p. 213) • Ileocecal intussusception (p. 213) • Ileal impaction (p. 208)
	Thickened loops (uncommon)	• Strangulated small intestine (p. 209) • Lymphoma (p. 233) • Proliferative enteropathy (p. 280) • Distal jejunal or ileal hypertrophy • Infiltrative or inflammatory bowel disease
Cecum	Gas distended or firm viscus on the right side of the abdomen	• Cecal tympany (gas filled) • Cecal impaction (ingesta-filled) (p. 214) • Cecocolic intussusception (firm mass) (p. 214)
Large colon	Gas distention	• Tympany • Impaction (PF or RDC) (p. 217) • Sand impaction (p. 217) • Enterolithiasis (p. 218) • Right dorsal displacement (p. 220) • Nephrosplenic ligament entrapment (p. 219) • Large colon volvulus (p. 220)
Small colon	Gas distention	• Strangulating lipoma (p. 209) • Enterolithiasis (p. 218) • Fecalith (p. 287)

Mass	Single or multiple firm and unindentable mass(es)	• Abscess (usually single)
		  ○ Penetrating foreign body
		  ○ *Streptococcus equi* subspecies *equi*
		• Neoplasia (single or multiple)
		  ○ Lymphoma
		  ○ Adenocarcinoma
		• Hematoma
		  ○ Pelvic injury
		  ○ Broad ligament hematoma
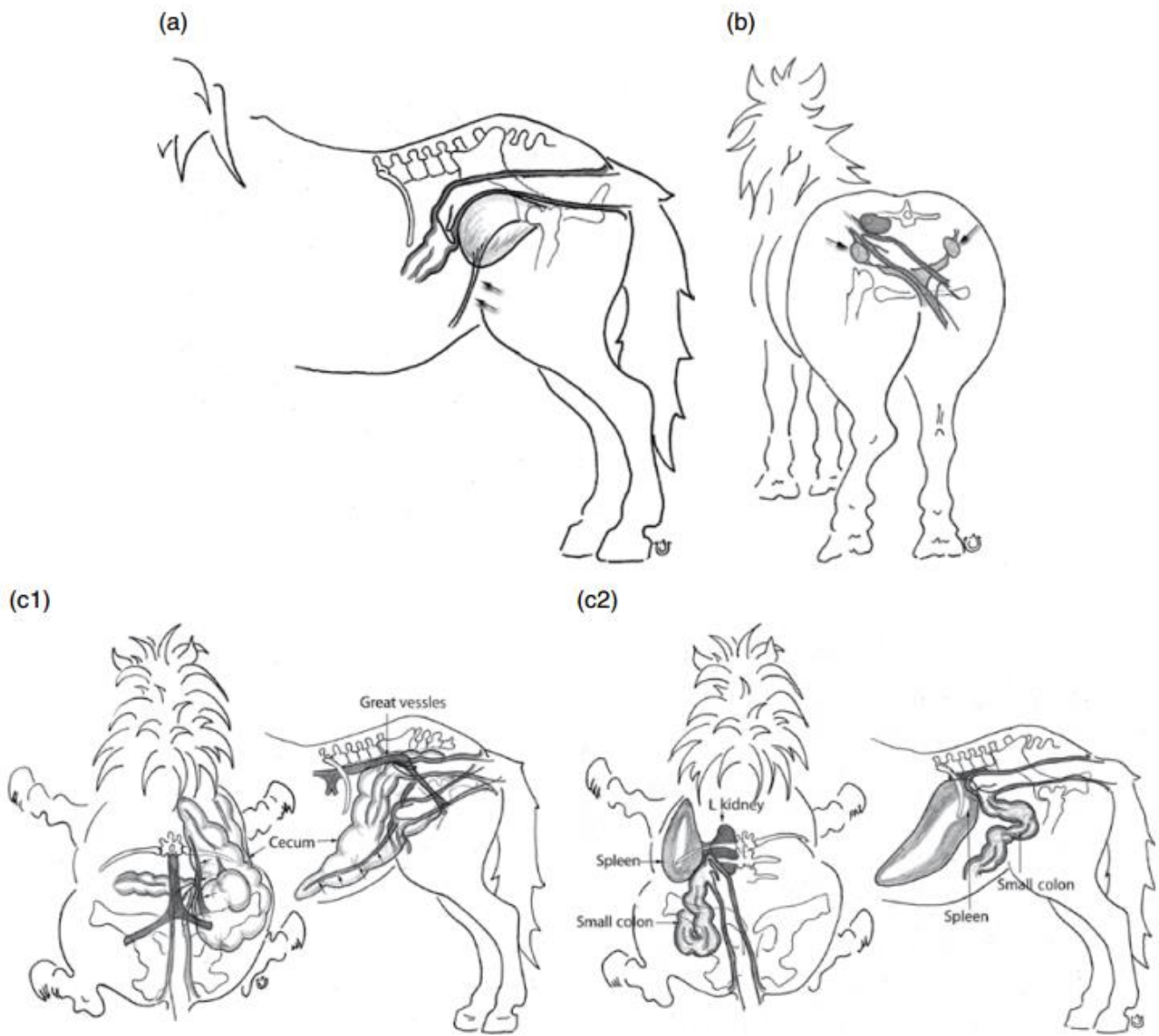
Figure 3.1 Schematic illustration of normal abdominal cavity anatomy as examined by palpation per rectum. (a) Normal urine distended bladder can be palpated on midline and distinguished from other viscera by the round ligaments (arrows). (b) Normal uterus and ovaries (arrows). (c) Palpable structures include medial/ventral cecal band on the right (arrows), great vessels along the dorsal body wall, caudal pole of the left kidney, dorsocaudal border of spleen adjacent to the left body wall, fecal balls in the small colon.

(a1)

(a2)

Duodenum

Cecum

(b)

Ileum

(c)
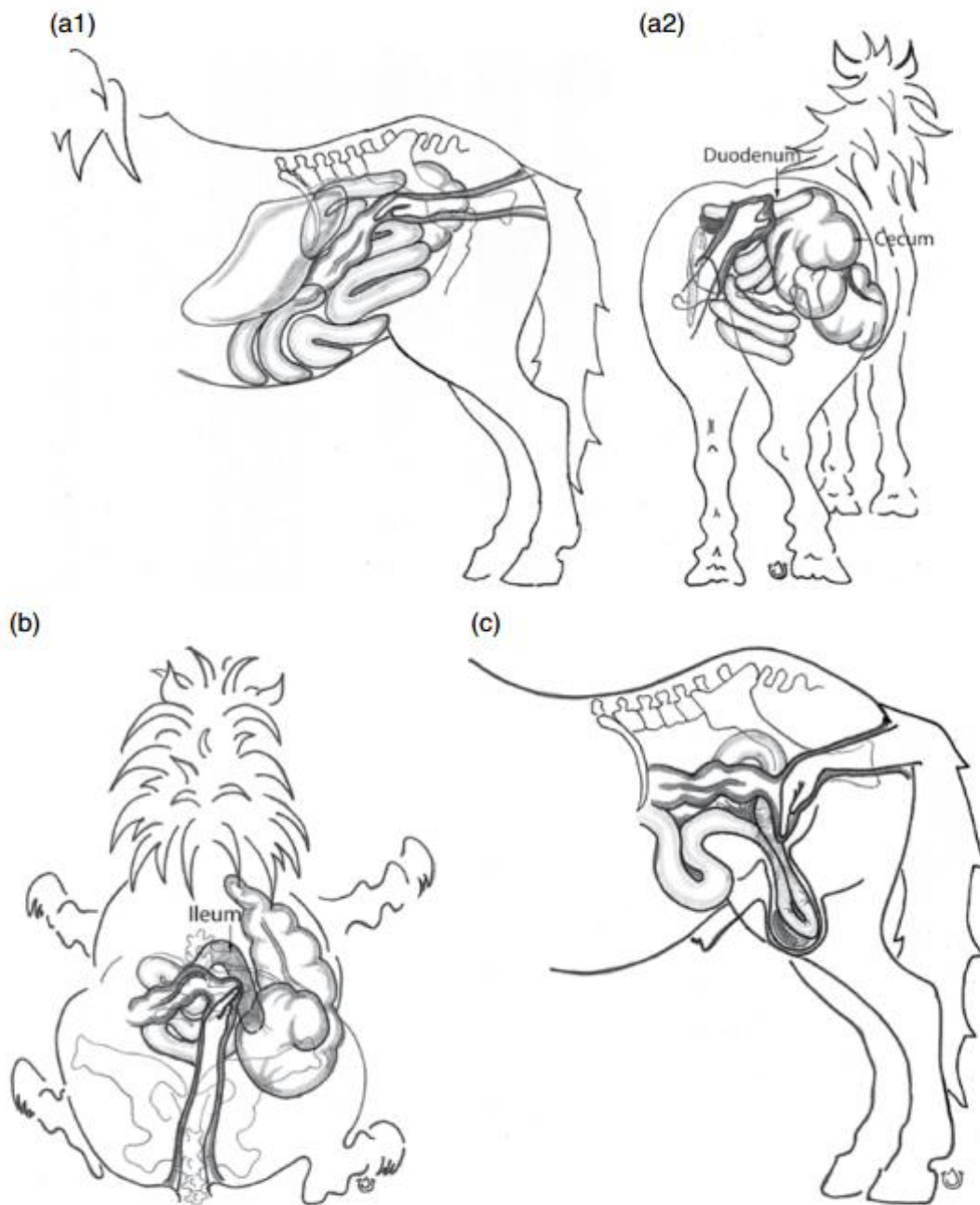
Figure 3.2 Abnormal small intestine. (a) Distended loops of small intestine (1) and distended duodenum coursing from right to left around the base of the cecum (2), (b) ileal impaction, and (c) inguinal hernia.
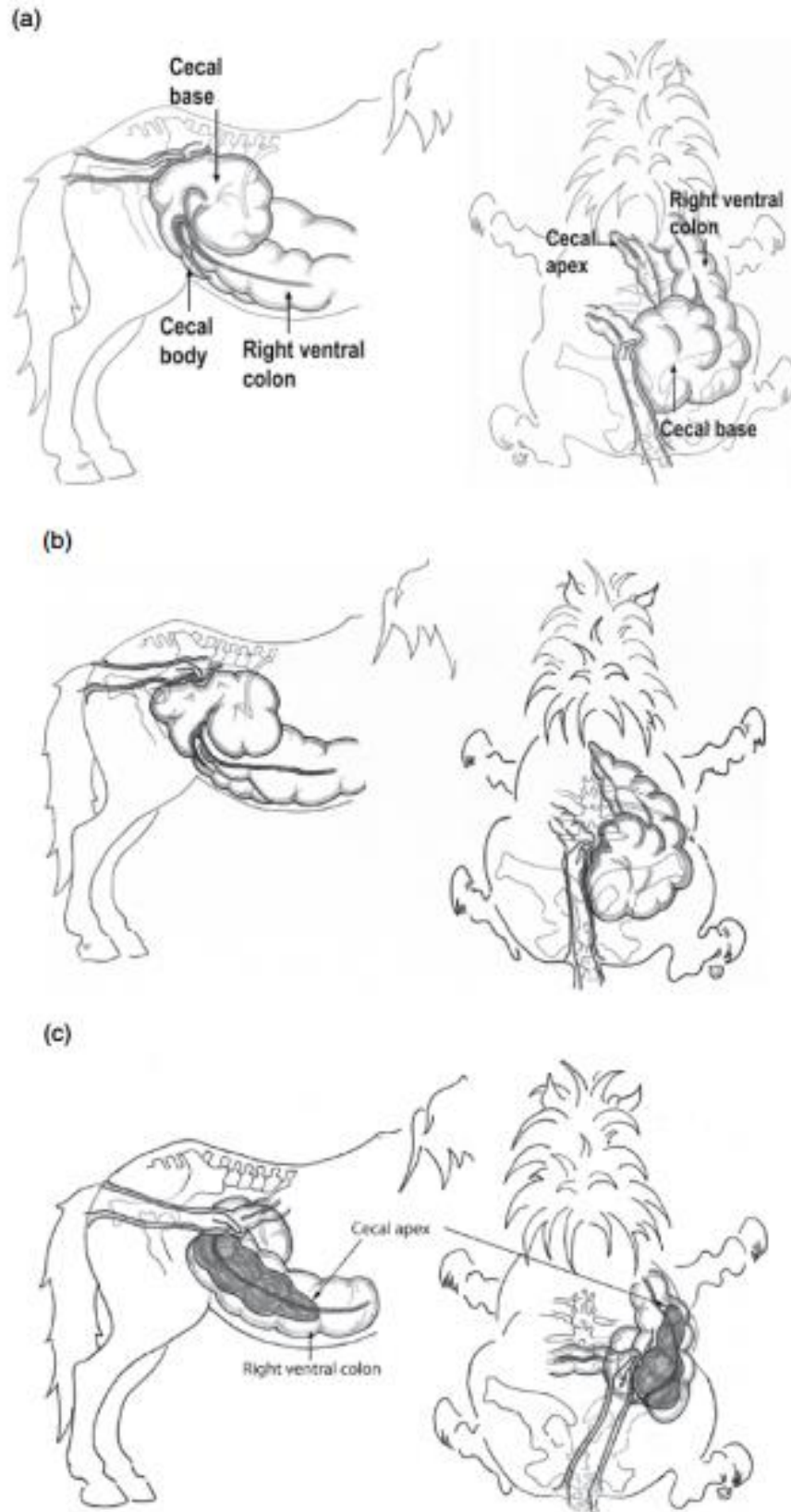
(a)

Cecal base

Cecal body

Right ventral colon

Right ventral colon

Cecal apex

Cecal base

(b)

(c)

Cecal apex

Right ventral colon

Figure 3.3   Cecal tympany (a), cecal impaction (b), and cecocecal or cecocolic intussusception (c).

(a)

Left ventral colon

Pelvic flexure

(b)

Cecum

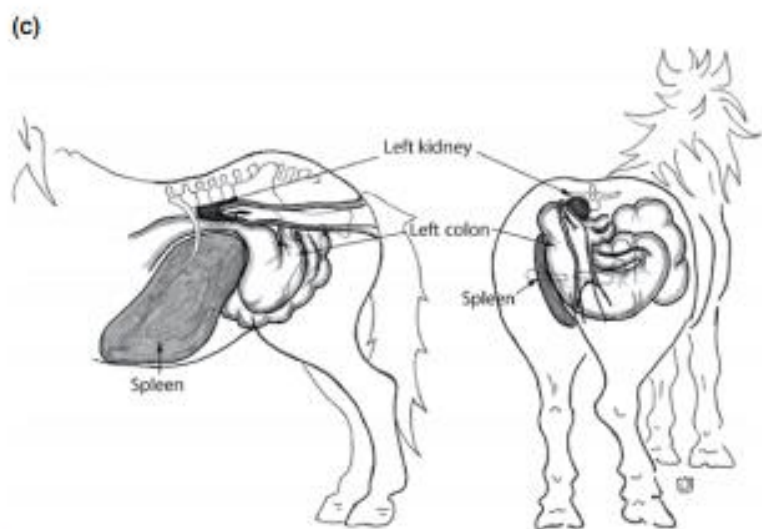Large colon

Cecum

(c)

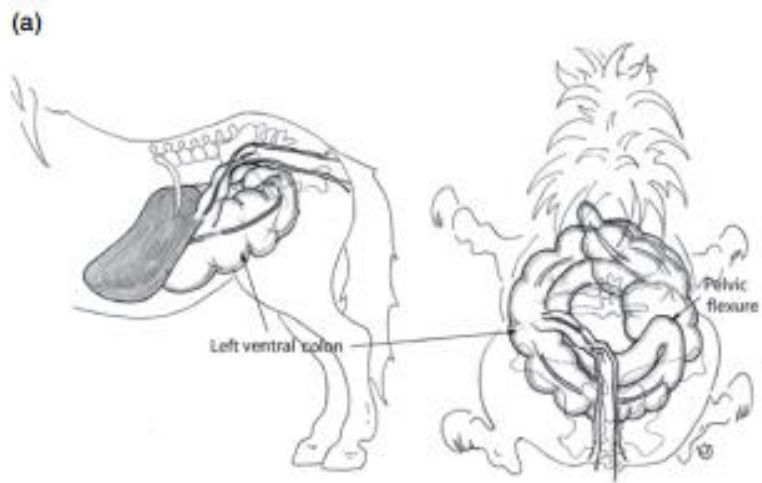Left kidney

Left colon

Spleen

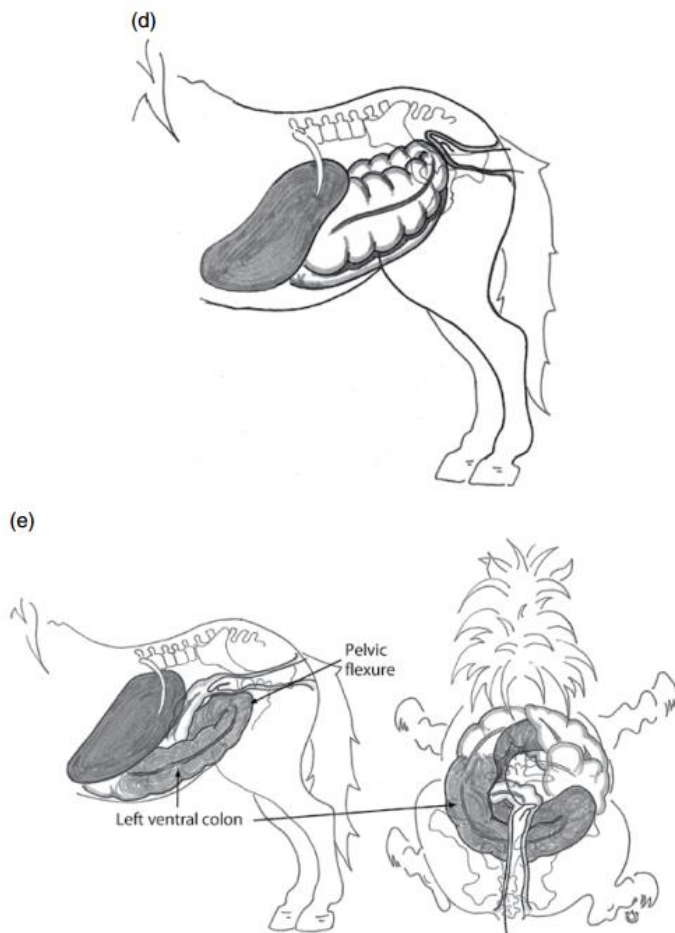Spleen
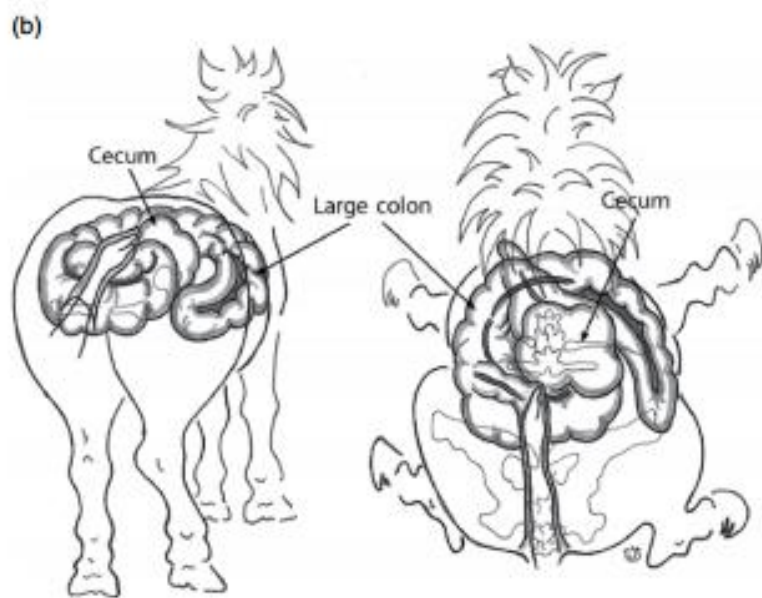
Figure 3.4 (cont'd)

Figure 3.4 Large colon lesions. (a) Large colon gas distention (tympany), (b) RDD, (c) NSLE, (d) LCV, and (e) PF (left ventral colon) impaction.
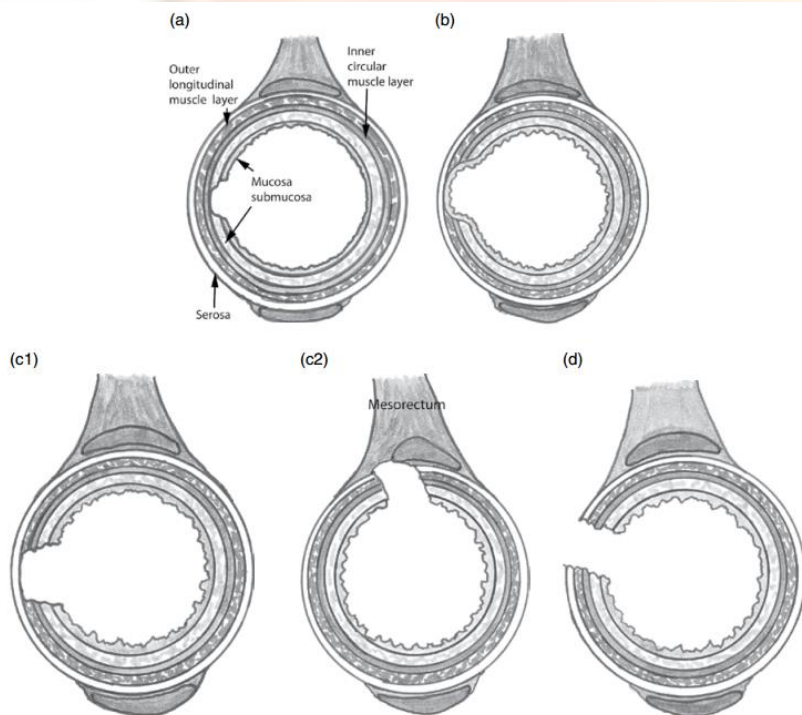

Figure 3.7 Rectal tear. (a) Grade 1 involving the mucosa and submucosa, (b) grade 2 involving the inner circular and outer longitudinal muscle layers only, (c) grade 3A involving all layers with the serosa intact and grade 3B involving all layers with the mesorectum intact, and (d) grade 4 full thickness tear.

8. Abdominal distention (PAUNCH)

Abdominal distention should always be evaluated in the context of the horse's normal appearance. The owner's opinion is often very useful in this analysis. The source of the distention, identified on rectal exam, will typically provide more useful information, but this can be useful for evaluation of disease progression.

9. PCV/TP

Decreased total protein with an elevated PCV indicates protein loss and dehydration, which together indicate a poor prognosis. Creatinine levels should be evaluated for the possibility of renal disease or dehydration. Elevations of gamma-glutaryl-transferase may indicate liver disease. Horses with colonic displacements may have elevated liver enzymes because of biliary outflow obstruction.

If an animal displays clinical signs of endotoxemia and/or dehydration, a "quick and dirty" PCV can be obtained by filling a purple (or green) top tube and letting it sit upright. The red blood cell should settle out within the time necessary to perform a physical exam, rectal exam, pass a nasogastric tube and relay one's findings to the owner. This will provide a rough estimate of the PCV and, if a refractometer is available, the total solids.

In a hospital setting, PCV/TP can provide a cheap, effective means of monitoring an animal's hydration status prior to and during intravenous and/or enteral fluid administration. While a PCV >60 is certainly a poor prognostic indicator, it does not mean that such a horse can't survive following aggressive medical (and often surgical) therapy. Combining PCV/TP with venous lactate and physical findings can give a reasonable indicator of peripheral perfusion.

10. PERITONEAL FLUID

Analysis of peritoneal fluid can often be extremely helpful, especially when differentiating between strangulating and non-strangulating small intestinal lesions and documenting cases of gastrointestinal perforation. One thing to remember: if the results of the test will not alter your treatment plan, it's probably best not to perform the test.

Analysis of abdominal fluid includes cell counts, cytology, total protein, and in some centers biochemical analysis. Normal equine peritoneal fluid should be translucent and very pale yellow to amber, with a total protein of < 2 g/dL and WBC <5,000 -10,000/µL. A few points to remember:

- Typically, strangulating lesions will result in a serosanguinous tap, while non-strangulating lesions will typically result in a normal tap or one with a slight to moderate increase in protein with normal WBC.

- Horses with strangulated small intestine can have normal peritoneal fluid early in the disease process.

- A serosanguinous tap, while suggestive of a strangulating lesion or otherwise compromised bowel, can result from blood contamination, a splenic tap, or hemoperitoneum. Platelets and hemosiderin-laden macrophages can differentiate.

- Ingesta or other feed particles in a tap can result from either enterocentesis or a ruptured viscus.

- An "oily" looking tap can result from lipid material and does not automatically indicate free mineral oil within the peritoneal cavity.

Abdominocentesis carries the risk of bowel laceration or enterocentesis, or amniocentesis in the term mare. Horses with sand accumulations are particularly at risk because the weight of the colon holds it in apposition to the ventral body wall.

Abdominocentesis can also be dangerous to the collector if the horse decides to kick, so caution is always indicated. Additionally, the needle technique should be used with caution in foals because the distended bowel is easily punctured

Abdominal ultrasonography can be used to localize accumulations of abdominal fluid and select alternative abdominocentesis sites. Ultrasound can be extremely helpful to determine the presence of a specific pocket of fluid or to characterize the fluid present.

ANCILLARY DIAGNOSTICS

Ultrasound:

Transabdominal ultrasonography can offer very useful information in the acute abdomen. Typically, a 3-7 mHz curvilinear transducer is used. Ultrasound will allow for a basic colic exam (presence of fluid, identification of SI distention, possibly SI wall thickness). Transrectal ultrasonography is not commonly used in cases of acute colic. The following basic parameters should be assessed:

- Objective measurement of small intestinal distention.
- Objective measurement of intestinal wall thickness, including duodenal size, thickness, and motility.
- Amount and character of peritoneal fluid.
- Estimation of gastric size.
- Estimation of SI and large colon contents (i.e. gas vs. fluid)
- Right dorsal colon wall thickness.
- Identification of the spleen and kidney in the left flank. While failure to identify the spleen does not confirm a nephrosplenic entrapment, identification of both makes that diagnosis much less likely.
- Identification of a target-like lesion typical of an intussception and inguinal herniation.
- The stomach can be evaluated for the presence of gastric fluid or squamous cell carcinoma.

Radiology:

Abdominal radiographs in the adult horse are limited to hospital facilities with specialized equipment. Even so, radiographs are essentially helpful for two major diagnoses: sand and enterolithiasis. Remember that the lack of a radiographically evident enterolith does not rule out the diagnosis, and some enteroliths can be difficult to differentiate from sand within the colon.

Endoscopy:

Gastroscopy is usually not indicated in cases of acute colic, but more commonly chronic or recurrent colic, poor performance, decreased grain consumption, etc. The stomach and proximal duodenum of foals and adult horses can be easily examined with appropriate equipment.

A 2-meter scope will allow access to the stomach of smaller horses, but not a complete examination of the stomach in average sized adults.

A 3-meter scope is necessary for complete examination of the body of the stomach, gastric antrum, pylorus, and proximal duodenum.

This is important as antral lesions can exist without other obvious squamous or glandular ulceration, and these lesions can easily be missed without a thorough examination. In order to facilitate a thorough exam, adequate fasting is essential: usually at least 12, preferably 16-18 hours off feed. Some clinicians withhold water prior to gastroscopy.

LAPAROSCOPY:

Laparoscopy can be a useful diagnostic tool in horses with both acute and chronic colic. In horses with acute colic, laparoscopy can confirm the need for an exploratory celiotomy or euthanasia. It is uncommon for a standing laparoscopy to be therapeutic in the horse with acute colic. When performing laparoscopy in the horse with acute colic, it is important to carefully enter the abdominal cavity to avoid penetration of a gas-distended viscus. An open-approach laparoscopy may be performed in horses with abdominal distention. In cases of chronic colic, the horse may be fasted and good visualization of the abdominal cavity may be obtained during diagnostic laparoscopy.

Laparoscopy has been used to diagnose trauma after foaling (tears of the small colon mesocolon, uterine rupture, hemorrhage into the broad ligament), abdominal cavity trauma (penetrating wounds), and splenic disease (tumors, hematomas, and ruptures). It also helps identify adhesions (Fig. 33-3), small intestinal strangulations, large colon displacements (Fig. 33-4), visceral rupture, and abdominal neoplasia.

Technique for Diagnostic Standing Laparoscopy:

The horse is restrained in standing stocks with the tail secured to prevent contamination of the flank region during surgery. A sedative analgesic combination (e.g., xylazine [0.4 to 0.6 mg/kg IV] and butorphanol tartrate [0.022 mg/kg]) is administered, and both flank regions are prepared for aseptic surgery. Additional analgesics may be administered as needed during the procedure. Local

anesthesia (10 to 30 mL) is infiltrated into the sites of trocar introduction both subcutaneously and intramuscularly. The primary site of trocar introduction is usually at the dorsal margin of the internal abdominal oblique muscle midway between the last rib and the tuber coxae. Accessory portals are established above or below this for instrument introduction. The use of adherent drapes is less traumatic to the standing horse than the use of penetrating towel clamps, unless all sites are infiltrated with local anesthesia.

The flank regions should have been previously evaluated for the presence of adherent viscera (via ultrasonography) or other contraindications for laparoscopic portal placement in that region. A 1.5-cm stab incision is made through the skin and underlying fascia to allow introduction of the first laparoscopic trocar or cannula (15 cm in length) assembly. The assembly is inserted aiming at the contralateral coxofemoral joint until resistance decreases. The laparoscopic telescope is then inserted and penetration into the abdominal cavity is confirmed or the laparoscope is found to still be in the retroperitoneal space. If the telescope is in the retroperitoneal space, a quick thrust with the 30-degree telescope will tear the peritoneum. Correct placement into the abdominal cavity is confirmed visually and by being able to freely move the laparoscope without patient discomfort. Insufflation with carbon dioxide to 10 to 15 mm Hg is commenced. Once the abdomen has been insufflated, systematic exploration should occur. Additional portals may be placed to allow introduction of instruments to facilitate manipulation of viscera.

When evaluating the left side of the abdomen, the first structure typically seen is the nephrosplenic ligament with the spleen and associated perirenal fat (Fig 33-5). The mesenteric root is then seen, as are sections of the small intestine and the colon. Passing the laparoscope over the nephrosplenic ligament cranially, the lateral and dorsal surface of the stomach is examined. The diaphragm and left part of the liver are seen further cranially. The evaluation of the caudal abdomen includes visualization of the urogenital organs (the ovary, uterus, and broad ligament in the mare, or the vas deferens and mesorchium in the male, and the urinary bladder). The rectum is noted dorsal to the urinary bladder. The inguinal rings may be evaluated.

The right side of the abdomen is typically evaluated by a separate entry portal in the right paralumbar fossa. The base of the cecum and duodenum are seen when first entering the abdomen. Looking above the duodenum, the right renal outline is seen. The liver is located ventrad and craniad to this, and the epiploic foramen may be entered. Looking caudally, the root of the mesentery is seen, as are sections of the small and large intestine. The right side of the urogenital tract is evaluated similarly to the left side. The use of a biopsy forceps or chambers catheter through a separate portal is helpful to probe organs and move viscera to improve visualization.

At the termination of the laparoscopic evaluation, the valves in the cannula assembly are held open to allow as much of the insufflating gas as possible to leave the abdominal cavity to improve postoperative patient comfort. The skin is sutured, and nonsteroidal anti-inflammatory agents are administered if necessary.
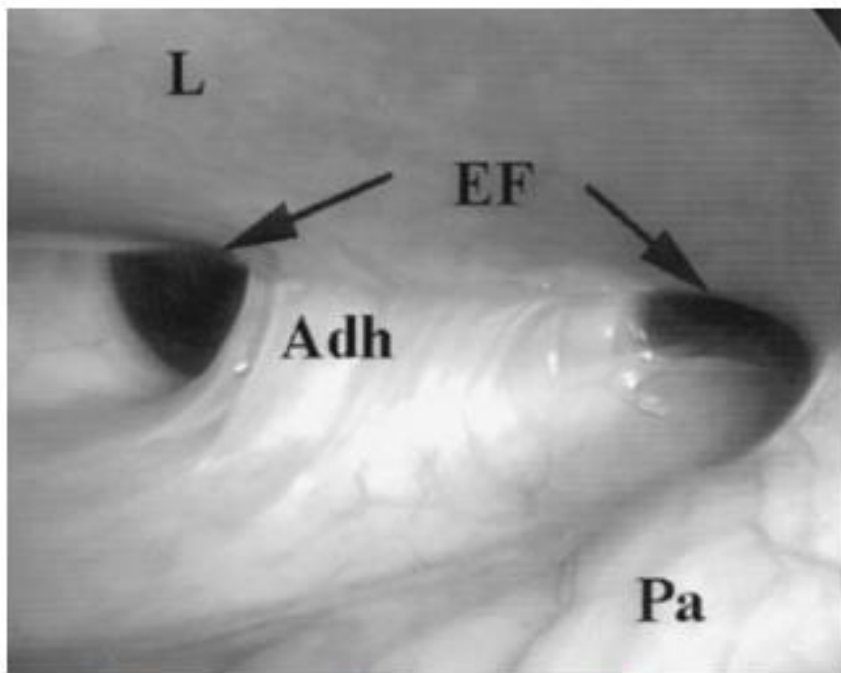
Figure 33-3. An adhesion (Adh) spanning the epiploic foramen (EF) as viewed from the right side. The caudate lobe of the liver (L) and the pancreas (Pa) border the epiploic foramen.
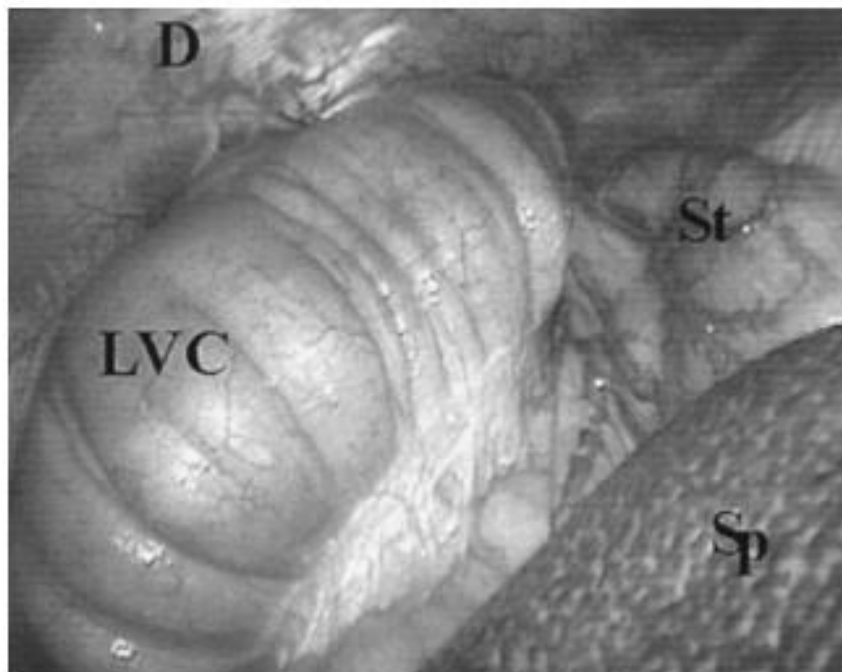

Figure 33-4. Left side laparoscopic view of a large colon displacement (i.e., retroflexion of the pelvic flexure). D, diaphragm; LVC, left ventral colon; St, stomach.
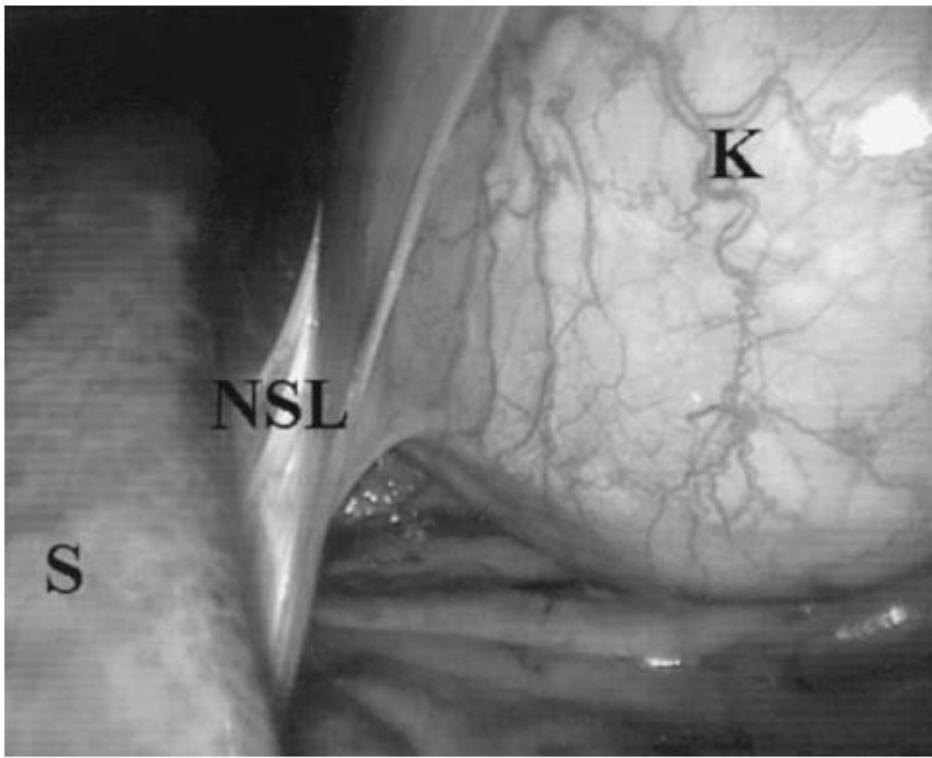
Figure 33-5. The nephrosplenic ligament (NSL) extends from the kidney (K) to the spleen (S).